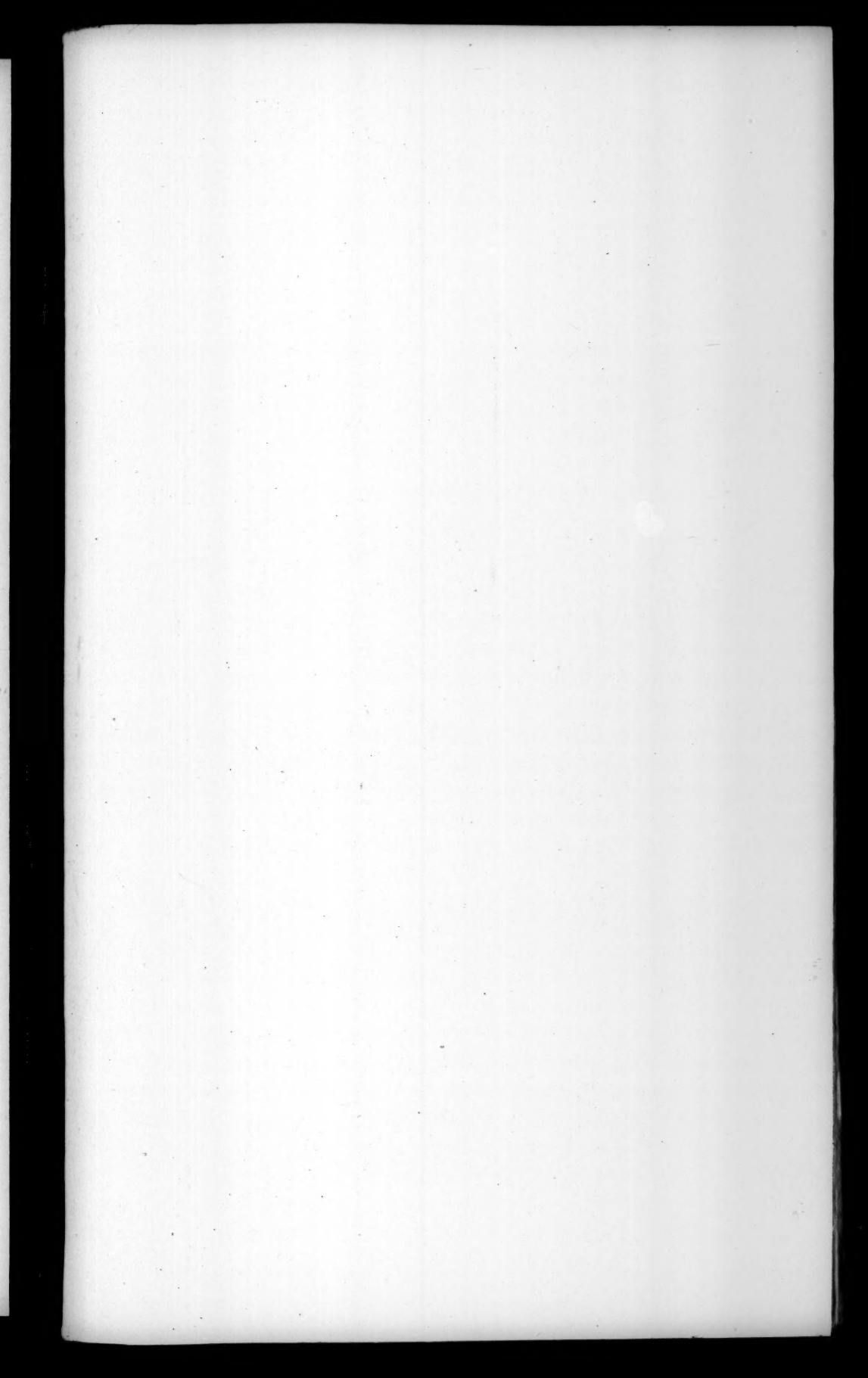




Rev^d Walter Arnold Vaughan, A.M.
Vicar of Chart Sutton, Kent.



Rev^d Walter Arnold Vaughan, A.M.
Vicar of Chart Sutton, Kent.



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W. A. Van Dyke.

1860

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AN
EXPOSITION
OF THE
PRINCIPLES
OF
Anatomy and Physiology.

VOL. I.

MA

PRINCIPLES

20

Anatomy and Physiology

DISCOVERIES - IMPROVEMENTS

PRAELECTIOES ANATOMICAE

FERDINAND

TRANSLATED FROM THE RUSSIAN

81 WALTER FAUCON M.D.

1330

NO. 1

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AN
E X P O S I T I O N
OF THE
P R I N C I P L E S
OF
Anatomy and Physiology,
FOUNDED ON THE
DISCOVERIES AND IMPROVEMENTS
OF THE
LATEST AND MOST APPROVED WRITERS,
AND CONTAINING THE
PRAELECTIONES ANATOMICAE
OF
FERDINAND LEBER,
TRANSLATED FROM THE ORIGINAL, PUBLISHED IN
LATIN, AT VIENNA.

By *WALTER VAUGHAN, M.D.*
PHYSICIAN, AT ROCHESTER, IN KENT.

The gen'ral ORDER, since the whole began,
Is kept in NATURE, and is kept in MAN.

POPE.

IN TWO VOLUMES.

VOL. I.

L O N D O N :

PRINTED FOR G. G. J. AND J. ROBINSON, PATERNOSTER-ROW

MDCXCII.

EXPOSITION

OF THE

PHYSIOLOGY

OF

Anatomy and Physiology

AND

EXPOSITION

OF THE

PHYSIOLOGY

OF THE

PHYSIOLOGY



Anatomy and Physiology

WALTER WATSON, M.D.

PROFESSOR OF ANATOMY AND PHYSIOLOGY

IN THE UNIVERSITY OF MICHIGAN

LEIPZIG, 1894

IN TWO VOLUMES

VOL. I

1894

PRINTED BY THE UNIVERSITY OF MICHIGAN PRESS

LEIPZIG

DEDICATION.

TO

DOCTOR WILLIAM SAUNDERS,
FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS,
FELLOW OF THE ANTIQUARIAN, AND SEVERAL
OTHER SOCIETIES, SENIOR PHYSICIAN TO
GUY'S HOSPITAL, LECTURER ON THE
THEORY AND PRACTICE OF
PHYSIC, &c. IN LONDON.

MY DEAR SIR,

IF the Favours which you have conferred
on me had been the Rewards of domestic Service, if they had been the Effects
of Importunity,—or gained otherwise than
by my honest Labours in learning and exercising the Healing Art,—I should not have

singled you out of all my Friends as most deserving to public a Testimony of my Gratitude.

You who have taught and practised Medicine so long with such just and universal Applause, and have acquired such Dignity and Reputation, are far above my Praise. But, as a grateful Scholar, permit me to assure you, that my constant and warmest Prayer is for the Happiness and Honour of your future Life,

I am, dear S I R,

With the greatest Respect,

Your most obedient humble Servant,

WALTER VAUGHAN,

ROCHESTER,

OZ. 11, 1790.

PREFACE.

(17)

P R E F A C E.

IT is a complaint equally true and lamentable, that the number of books on Anatomy and Physiology is too great, and that there is none which is not either so prolix and imperfect as to distract the most intent reader, or so concise and difficult as to deter even the student.

Books on Anatomy seldom treat of Physiology, but contain mere Descriptions of Parts, without any relation to their primitive formation, their possible changes, or their functions and actions. Hence, the study of Anatomy has always been accounted difficult and tiresome, and Books and Professors have been esteemed in proportion as they united an easy Physiology and Pathology to their Anatomy.

Boerhaave was the first who successfully united the Physiology to the Anatomy (*a*), and Haller, his scholar, found it afterwards necessary to attempt a similar work; in which attempt he far exceeded his master (*b*). But Haller never intended to make his work more than an abridgment; so that he has frequently made assertions, and frequently contradicted, without assigning the motives for either. Perhaps he wished the curious to search his *Elementa*; but if he had seriously considered their price and size, he might easily have been convinced that they were too expensive for the generality of purchasers, and too voluminous for the generality of readers.

(*a*) Boerhaave wisely thought “ *propriorum cogitatorum; Explicatione docentem plus proficere, quam si Opus ab alio conscriptum interpretari suscipit. Sua quippe optime intelligit, sua cuique prae caeteris placent, unde clarior fere Doctrina, atque animata plerumque sequitur Oratio.*”

Praef. ad Inst. Med. Ed. Leid. 4.

(*b*) Haller observes “ *etsi antea Boerhaavii Libro ad ordinandas Praelectiones usus fuerit, proprias tamen postea in Paginas dicere incepisse, quod ab istius inde Temporibus Anatome ita locupletata sit ut a se ipsa plurimum differat, &c.*”

Praef. ad Primas Lineas Phys. Ed. Goet. 1747.

In

In imitation of Boerhaave and Haller, Doctor Blumenbach, a Professor at Göttingen, has lately published *Institutiones Physiologiae*; he likewise imagining that he could teach better from his own book, in which he had availed himself of late improvements, than from that of any other who had written before him. But in this work, I think, there is too little Anatomy, and too much Physiology and Hypothesis.

I know a Professor, justly celebrated at this time, whose lectures on the bones are as pleasant as on any other part of the animal body; I think they are more pleasant, for he makes so many physiological and pathological remarks, that while he fixes in one's memory the situation, connection, figure, &c. of every bone, and every bony process, he enlivens his description with a continual reference to the same bone, or bony process in brute animals, illustrates its uses by familiar examples, and confirms his doctrines both by Physiology and Pathology.

It is certain, the mind is greatly alleviated by alternately changing pure description for reasoning ; and it is most retentive of causes and effects, when it has once perceived their connection with each other. I know not what led me to think myself capable of executing such a work as I now offer to the public ; but as I had sensibly felt the want of it myself, it can hardly be deemed unnatural that I should attempt it for the sake of others.

Even when I had finished it, for no man ever helped me in any other way than by lending me books,—I was so diffident of its merit, that had I not been urged by many who perused it, and chiefly by my good friend and late preceptor, Doctor William Saunders, who promised it a most honourable designation, it had still been withheld from the press.

It was my original design to comprize the whole in a small space. I did not even think of translating the *Praelectiones anatomicae* of
 Leber.

Leber. But I had scarcely begun, when I was led, by the high character which Leber's book bore in the University of Edinburgh, to make it a part of my own work. After having perused it, with great care, it seemed very suitable to my purpose, for I thought it, of all the Systems of Anatomy which I had ever seen, the plainest; short indeed, but neither obscure nor very defective (c);
so

(c) Winflow's *Exposition Anatomique de la Structure du Corps humain* contains scarcely any thing about the Absorbing Vessels; and Sabatier's *Traité Complet d'Anatomie*, which has never been translated into English, contains only what our countryman, Mr. Hewson, had published long ago. Besides, both of them want much which might be added from the writings of the moderns, and have so much error blended with their good, that to distinguish the one from the other, supposes at least a knowledge of both.

Verheyen and Palfin I say nothing of, because the former is shown, by Heister, to be egregiously faulty, and the latter, an useful book, is written with a view to Surgery.

Treatises on particular subjects in Anatomy, and *Compendia*, are too numerous to be separately spoken of. The latter can only be useful to proficients, or in Schools of Anatomy.

An

so that I doubted not but it was safer and more becoming to introduce it in an English dress, than to risque my own reputation in unnecessarily composing anew.

All, therefore, that I have done in the anatomical part of this work is to render that of Leber perfect. What is obscure in

An edition of Leber has been lately published at Edinburgh, by Doctor Wilson, in consequence of the great desire for that book; and he has added to it *Observationes quaedam physiologicae et anatomicae*, in thirty-four pages. Of the necessity for those observations, without more, I leave others to judge. I cannot, however, help remarking, that although I have compared the work itself, as published by Doctor Wilson, with my own copy published at Vienna, and find no material difference, yet Doctor Wilson, for some reason which I cannot divine, has omitted the preface to the German Edition, which Leber prefixed to the Latin! I have, however, translated it, and placed it as it was designed by Leber; and when it is considered that Leber has given no plates, but has acquainted us, in this preface, which he preferred, and pointed out the authors, which he thought most worthy to be consulted, and which he had consulted in writing his own lectures, I think I shall be considered as having done as I ought.

him,

him, I have endeavoured to illustrate ; and what is erroneous, I have endeavoured to correct. I have, however, been so cautious, and so convinced of the goodness of his work, that I have spared no pains to deliberate on every part that seemed exceptionable. And wherever I ventured to differ from him, I have done it so modestly, that I cannot suppose Himself, or his Admirers, will be so infatuated and vindictive as to search after, and magnify faults in mine, only because I have discovered some in his. I am not desirous to exalt myself into an antagonist, under any pretence.

As for the omissions in Leber, I have supplied them as often as I could, by selecting carefully, and arranging methodically what is admitted by acknowledged judges, or seemed certain to myself. He is chiefly deficient in his section on the *Lymphatic Vessels*; and in the *Splanchnology*, he has scarcely said any thing satisfactory about them. But, as he referred us to Hewson for farther information on them, it is probable he only copied from him.

Professor

Professor Leber has given no Figures ; neither have I given any. Of his descriptions, however, it may be said, as it was of Linné's "*Figuris non egent.*"—I think Figures are of little, if any use, unless to those who are attending Lectures, or who have attended them ; and of no use at all to those who never attend any. I am much of the same opinion as Haller, who thought it ridiculous to confine the eye to an "*inane album Arteriarum, Venarum, et Nervorum.*"

The physiological part is entirely mine : if I may call that mine, which I adopt, and hold to be right, and which I have incorporated into a regular system.

Nobody, I flatter myself, will say I have done an useless work ; because I refer to every claimant that which I believe to be his due. And should I ever seem, by omitting an acknowledgment, to arrogate to myself the property of another, I would have it understood that I thought it mine, when I wrote it.

As

As I have not taken authorities from authority, the number of my authorities will give authenticity to my work. And whilst they prove my diligence, they will serve to direct the inquisitive to the best sources.

Some praise, I think, may not unreasonably be expected for citing none but good authors: and more may certainly be claimed for not having cited their errors (*i*).

The fallibility of human judgment is universally known. The reverence due to ancient authors, and the prejudice against the modern; the prevalence of custom, the mutability of form, and the prescriptive suffrage of exalted characters; are, all of them, in some manner, unfavourable alike to the innocent temerity of youth, and the pertinacity and scepticism of old age.

(*i*) *Ex libris colligere quae prodiderunt auctores, longe est periculosissimum: rerum ipsarum vera cognitio è rebus ipsis est.*

J. C. Scaliger.

I hope,

I hope, I have not been unwarrantably officious in giving my own opinion; nor too resolute in maintaining it. I hope, I shall not seem to have dealt superciliously by any man; or to have given his doctrines too briefly, or in ambiguous and doubtful language; for I confess, I love to think for myself; and rather to view things by the light of reason, than the deceitful medium of authority (*j*).

I would not have it supposed that I renounce all probable conjecture. For where I cannot employ my Reason, I love to hu-

(*j*) " To speak generally, an argument from authority to wiser examinations, is but a weaker kind of proof; it being but a topical probation, and as we term it, an inartificial argument, depending upon a naked asseveration; wherein neither declaring the causes, affections, or adjuncts, of what we believe, it carrieth not with it the reasonable inducements of knowledge. And, therefore, *Contra negantem principia, Ipse dixit,* or *Oportet discentem credere,* although postulates very acomodable unto *junior* indoctrinations, yet are their authorities but temporary, and not to be embraced beyond the minority of our intellectuals.

Brown's Vulgar Errors, chap. vii."

mour

mour my Fancy. But if this be deemed a fault, I have committed it so seldom, that my benevolent reader will easily forgive me. Indeed, I cannot be accounted very reprehensible for it, since what is given only as uncertain, can hardly be taken for certain.

That I have made Notes which are unnecessary for many, is not to be wondered at. An Expofitor, however diffident and circumspect, must write too much for some, and too little for others.

I have, on all occasions, consulted order, and endeavoured to avoid needless repetition. And if in any instance I have adduced contrary opinions, without reconciling either, or any of them, to truth; I would apprise the reader, that the authors of both, or of all the opinions, are equally intitled to belief, and that to have determined which had the better cause, supposes more ample knowledge and more acute discernment than I can pretend to possess.

In

In my language, as I am not stricken in years, nor used to composition, I only aim at accuracy. If I unfortunately seem affected, I can safely affirm that I affect nothing ungrammatical or palpably erroneous; nothing that can make my style intricate, or my meaning obscure and uncertain. Should my manner be peculiar, there is nothing blameable in it, because I could not help it; and, if I judge right, singularity in this respect may be advantageous.

However anatomical language may need improvement, and however reasoning and language may be considered as connected (*k*), I have consulted neither Skinner, nor Junius,

(*k*) The Abbé de Condillac's Maxims are held in great estimation by Mons. Lavoisier, who quotes him, saying —“ We think only through the medium of words—Languages are true analytical methods.—Algebra, which is adapted to its purpose in every species of expression, in the most simple, most exact, and best manner possible, is, at the same time, a language and an analytical method.—The art of reasoning is nothing more than a language well arranged.

Traité Elem. de Chimie.

about

about the etymology of old words, or the utility of making new words. For I am not extravagantly fond of innovation, and as Books on Anatomy have long since worn a party-coloured dress, I am not inclined, at present, so far to transgress the majesty of custom as to strip mine of it.

Publica forma placet Sermonis :
Verba valent Usu, sicut Nummi,

WALTER VAUGHAN.

(viii)

about the expediency of old words of the
kind of making new words. For I am
not exactly only a word-monger, and
a books of words. I have had these words
a pretty good deal, and I am not inclined to
give them to the world. I have the words
of the world, and I have the words of the
world, and I have the words of the world.

PROFESSOR LEECH
Lectures on the History of the English Language
and Literature

L A T I N E D I T I O N
WALTER VAUGHAN

L E C T U R E S

I N the present Edition I have supplied the
Notes, and corrected the inaccuracies
in the German Edition of this Book. The
Order, which I have followed for these
teen Years past, since I acquired a Professor-
ship, I always accounted the best and fittest
for my public Lectures. For which Reason,
Vol. I. 25 I have

(XX)

I have rendered this Work more useful as well as more agreeable. I had, indeed, a Mind to suggest Corrections necessary in the Practice of the Art; as I always do in my public Lectures: but I changed my Mind, lest my Work should be too large.

THE
P R E F A C E
OF
P R O F E S S O R L E B E R
TO HIS
L A T I N E D I T I O N
OF THESE
L E C T U R E S.

IN the present Edition I have supplied the Defects, and corrected the Inaccuracies in the German Edition of this Book. The Order, which I have followed for these fifteen Years past, since I acquired a Professorship, I always accounted the best and fittest for my public Lectures. For which Reason,

(xx)

I have rendered this Work more useful as well as more agreeable. I had, indeed, a Mind to suggest Cautions necessary in the Practice of Surgery; as I always do in my public Lectures: But I changed my Mind, lest my Work should be too large.

VIENNA,

Feb. 13, 1777.

(XX)

I have rendered this Work more useful as
well as more agreeable had indeed a
Mind to suggest the necessity in the
Practice of Surgery I always do in my
Public Lectures but I changed my Mind
lest my Work should be too large.

THE
P R E F A C E
OF
P R O F E S S O R L E B E R
TO HIS
G E R M A N E D I T I O N
OF THESE
L E C T U R E S.

•

I HERE offer a system of Anatomy, written in the German Language; sensible that it is my duty, especially at this time, to furnish my students with it. For I confess, I long wished for such a work, and long felt the loss of it. It is clear that the want of a Book in the vernacular idiom has retarded

tarded the acquirement of Anatomy among German students who were ignorant of the Latin Tongue. Hence many celebrated men have openly declared the usefulness of a work of this kind.

Anatomical Science is of itself tiresome to the memory. And a vast inundation of technical Terms, as well Greek as Latin, is not only more tiresome, but also more perplexing. The progress of Anatomy has therefore been very much obstructed by it. A German Translation of the technical terms, and a German Exposition of the whole Science of Anatomy, must render it more easy, especially as I have taken all possible pains to give definitions exact, short, and intelligible. The technical terms may not only be retained with ease, when they are written in the German language, but they are more illustrative of the ideas of things, to German students, than when written in Latin. Besides, an exposition of Anatomy in German, without the mixture of Latin words, must be of the same importance.

portance. For it is equally as necessary to understand the connection and order of things, and the names by which they are signified, as the things themselves.

This method will, perhaps, seem difficult to those who have learned Anatomy variegated with Latin terms: But they who are beginning to learn it, will, I think, find it easy.

I have now assigned the motives for undertaking and completing this work. My end was to do good, and the satisfaction which I have always felt in being serviceable to my neighbour, by the discharge of my duty, will be the only reward that I wish for.

If any one be desirous of being better instructed than he can by my Lectures, he may consult the *Elementa Physiologiae* of HALLER, the *Exposition Anatomique* of WINSLOW, the various works of MECKEL,

the *Osteology* and *Neurology* of MONRO, the *Osteology* of BERTIN, and the *Doctrine of the Lymphatic Vessels*, by HEWSON.

The best figures are the *Tabulae Myologicae, et Osteologicae* of ALBINUS, the *Tabulae Myologicae* of COWPER, and the *Tabulae Anatomicae* of HALLER. Formerly, ALBINUS gave figures of the Gravid *Uterus*: But the most exact, most elegant, and useful are those of the great London Anatomist, DOCTOR HUNTER.

Of the *Ligaments*, the Tables of WEITBRECHT, of the *Cardiac Nerves*, the Tables of NEUBAVER, and of the *Brain*, the Tables of TARIN, are most esteemed. Should any one be desirous of Tables of all Anatomy, the most exact are those of EUSTACHIUS, published by ALBINUS.

The present work may be considered as the *first Part* of my Lectures. I shall
 2 publish

publish the *second Part*, or *Lectures on Surgery*, in composing which I am now engaged, next year.

CONTENTS

CONTENTS

OF THE

FIRST VOLUME

Os Anatomia	1
Anatomia	1
Comparative Anatomy	1
Division of Anatomy	2
Constitution of the Human Body	3
Solids of the Body	4
Fluids of the Body	7
Blood	11
Osteology	19
Movable Connections of Bones	29
Bones of the Head	32
Skull	38
Os Frontis	38
Ossa Parietalia	42
Os Occipitis	47
Ossa Temporum	51
Bones of the Ear	58
Os Sphenoidale	63
Os Ethmoidale	67
Ossicula	

C O N T E N T S

OF THE

F I R S T V O L U M E.

	Page.
OF ANATOMY in general - -	1
ANATOMY defined - -	ibid.
COMPARATIVE ANATOMY -	ibid.
DIVISION of <i>Anatomy</i> - -	2
CONSTITUENT PARTS of the human Body	3
SOLIDS of the Body - - -	4
FLUIDS of the Body - - -	7
BLOOD - - - -	11
OSTEOLOGY - - -	19
MOVEABLE CONNECTIONS OF BONES	29
BONES of the Head - -	32
Skull - - -	38
Os FRONTIS - - -	38
Ossa PARIETALIA - - -	45
Os OCCIPITIS - - -	47
Ossa TEMPORUM - - -	51
BONES of the EAR - - -	58
Os SPHOENOIDALE - - -	63
Os ETHMOIDEUM - - -	67
OSSICULA	

OSSICULA TRIQUETRA	- - -	70
BONES of the UPPER JAW	- - -	72
ANTRUM MAXILLAE SUPERIORIS	- - -	76
OSSA NASALIA	- - -	78
OSSA LACRYMALIA	- - -	79
OSSA ZYGOMATICA	- - -	80
OSSA PALATINA	- - -	81
Os VOMER	- - -	84
OSSA SPONGIOSA INFERIORA	- - -	85
MAXILLA INFERIOR	- - -	87
Of the TEETH	- - -	89
DIVISION of the Teeth by Mr. Hunter	- - -	91
FORMATION of the ALVEOLI, TEETH,	- - -	
their Bony Part and ENAMEL	- - -	96
Of the NOSTRILS	- - -	100
ORBITS	- - -	101
BONES of the TRUNK	- - -	108
SPINE	- - -	109
VERTEBRAE of the BACK	- - -	116
LOINS	- - -	118
BONES of the THORAX	- - -	119
STERNUM	- - -	120
RIBS	- - -	123
PELVIS	- - -	128
Os SACRUM	- - -	129
COCCYGIS	- - -	132
OSSA ILII	- - -	134
ISCHII	- - -	136
PUBIO	- - -	138
SCAPULA	- - -	143
CLAVICLE	- - -	147
Os BRACHIALE	- - -	148
		CUBIT

CUBIT	-	-	-	151
RADIUS	-	-	-	153
CARPUS	-	-	-	156
METACARPUS	-	-	-	161
FINGERS	-	-	-	164
OS FEMORIS	-	-	-	167
LEG	-	-	-	171
TIBIA	-	-	-	ibid.
FIBULA	-	-	-	173
PATELLA	-	-	-	175
TARSUS	-	-	-	177
METATARSUS	-	-	-	182
OSSA SESAMOIDEA	-	-	-	185
SYNDESMOLOGY	-	-	-	187
Of the RECENT BONES	-	-	-	ibid.
PERIOSTEUM	-	-	-	ibid.
NATURAL COLOUR of the BONES				190
CARTILAGES	-	-	-	192
MARROW	-	-	-	196
SYNOVIAL GLANDS	-	-	-	199
SYNOVIA	-	-	-	200
VESSELS and NERVES of RECENT BONES				201
LIGAMENTS in general	-	-	-	204
of the lower jaw	-	-	-	207
connecting the <i>Os Occipitis</i>				
to the cervical <i>Vertebrae</i>				208
of the other VERTEBRAE				209
connecting the RIBS and				
STERNUM	-	-	-	210
of the BONES of the PELVIS				213
of the CLAVICLE and				
SCAPULA	-	-	-	213
				LIGA-

LIGAMENTS of the SHOULDER	-	216
FORE ARM	-	ibid.
CARPUS	-	218
METACARPUS	-	219
FINGERS	-	ibid.
HAND	-	220
OS FEMORIS	-	222
FIBULA	-	225
TARSUS	-	226
METATARSUS	-	227
TOES	-	228
FOOT	-	ibid.
MYOLOGY	-	231
MUSCLE	-	231
MUSCLES of the HEAD	-	235
Cranium	-	238
EYE-brows	-	240
EYE-lids	-	241
BALL of the EYE	-	243
EAR	-	245
CARTILAGES of the EAR	-	247
INTERNAL EAR	-	248
Nose	-	250
MOUTH and LIPS	-	251
lower JAW	-	256
OS HYOIDES	-	259
Tongue	-	261
soft PALATE and UVULA	-	266
Larynx	-	268
RIMA GLOTTIDIS	-	269
Head	-	271
Neck	-	275
MUSCLES		

CONTENTS.

xxx.

MUSCLES of the Back and Loins	-	279
<i>Os Coccygis</i>	-	285
<i>Thorax</i>	- -	286
<i>Humerus</i>	- -	294
<i>Clavicle</i>	- -	296
<i>Scapula</i>	- -	296
<i>Arm</i>	- -	297
<i>Fore-arm</i>	- -	302
<i>Hand</i>	- -	306
<i>four Fingers</i>	-	308
<i>fore Finger</i>	-	312
<i>little Finger</i>	-	313
<i>Thumb</i>	- -	314
<i>Palm of the Hand</i>	-	318
<i>Thigh</i>	- -	319
<i>Leg</i>	- -	325
<i>Foot</i>	- -	330
<i>Toes</i>	- -	333
<i>great Toe</i>	- -	337
<i>Abdomen</i>	- -	340
<i>Anus</i>	- -	344
<i>urinary Bladder</i>	-	346
<i>Testicles</i>	- -	346
<i>Penis</i>	- -	347
<i>Vagina</i>	- -	349
<i>Clitoris</i>	- -	350
ANGIOLOGY	- - -	351
VESSELS in general	- -	ibid.
ARTERIES	- - -	ibid.
ARTERIAL SYSTEM	- -	359
VEINS	- - - -	356
		VENOUS

VENOUS SYSTEM	-	-	-	396
CIRCULATION of the Blood in a <i>Foetus</i>				404
LYMPHATIC VESSELS	-	-	-	406
SYSTEM	-	-	-	412

O F

A N A T O M Y

I N G E N E R A L.

ANATOMY ⁽¹⁾ is a science teaching the fabric of the human body ⁽²⁾, by an artificial dissection of its parts.

Anatomy

(1). The strict meaning of the word ANATOMY is *Dissection*, or the *cutting Parts asunder* (See the *Composita ex TEMNO*, in Scapula's Lexicon.). But its common and general meaning is that given in the text. By "the fabric of the human body" is to be understood, the structure, figure, number, magnitude, and connection of all its parts.

(2) The anatomy which Professor Leber teaches, is a science of the human body only. But Malpighi, Grew, Feldman, Hales, Gesner, and Ludwig, are called by Linné ANATOMISTS (*Phil. Botan. edit. 2. p. 15. § 44.*); because they examined the internal structure of plants.

The examination of the fabric of brutes is also Anatomy. And a knowledge of the fabric of brutes and plants, when applied by analogy to explain the structure and functions of man, is called COMPARATIVE ANATOMY.

Thomas Bartholine, though he defines Anatomy like Leber, acknowledges that brutes are also subjects of dis-

Anatomy is divided into seven parts: viz.

1. Osteology,	} which delivers the doctrine of the	Bones.
2. Syndesmology,		Ligaments.
3. Myology,		Muscles.
4. Angiology,		Vessels.
5. Neurology,		Nerves.
6. Adenology,		Glands.
7. Splachnology,		Viscera.

The

section. But his reasons for confining his definition to the human body are very satisfactory. He does not dissuade one from dissecting brutes: on the contrary, he says, it is not the less useful for his not comprehending it in his definition of Anatomy; he says, it ought not to be neglected; whether we consider the analogy between man and brutes, or anatomical and surgical practice: Lastly, He tells us that Democritus searched after the seat of the bile in animals; that Galen dissected apes and other animals; that Asellius discovered the lacteal vessels from dissecting brutes; and that himself, as well as many others, whom he mentions, had dissected animals of various kinds (*Anat. Reform. p. 1.*).

Of the *Analogy between Plants and Animals*, it may be right to say a few words. Plants, like animals, have vessels, and fluids moving in them. Plants perspire; and their perspiration, says Hales, (*Statical Essays, Vol. I.*), is greater or less, as they are more or less exposed; and as the atmosphere is more or less loaded with moisture. Plants absorb also, as Hales, first of all observed: And Guettard (*Mem. de l'Acad. de Sciences, 1749.*), Du Hamel (*Phys. des Arbres. Tom. I.*), and Bonnet (*Traité des Feuilles. Mem. I.*) have ascertained what parts of plants absorb most, and what are the circumstances increasing and lessening their absorption. Plants have a secretion; for the *nectarium*, which is apparently a gland, secretes a liquor like honey. (*Linnaei Ammaen. Acad. Tom. V.*). Plants have a life also, and are stimulated by external causes; they are, like animals, capable of regenerating parts

The Principles or Constituent Parts of the Human Body.

The Human Body consists of *solid* and *fluid* parts ⁽³⁾. The solid parts are subdivided into

parts cut off, or otherwise destroyed (Bonnet *Contempl. de la Nature. Tom. I. p. 6. cap. 10.* and A. J. G. Murray's *De Redintegratione Partium Corporis Animalis, &c. Gott. 1787.*). Such is the analogy between plants and animals. The sexes of plants (*Lin. de Sexu Plant.*), their constant inclination towards the sun, the power by which their roots turn aside from veins of bad earth, and search for good (Buffon, Vol. II. p. 7. Smellie's Transl.), the power by which they maintain a certain temperature, though different from that of the atmosphere (Hunter, Phil. Trans. Vol. LXV.), and their sleep, are objects well worth attending to; though they cannot be discussed here.

(3) This is a very old division of the body; it differs little or nothing from that of Hippocrates (*Epid. XII. VI. § 8.*), and Galen; the former of whom called those parts that contain fluids, or serve for their transmission, **CONTAINING PARTS**. Consequently there were **CONTAINED PARTS**. Hoffman, however, makes a formal subdivision of the fluid parts, and distinguishes those that are obvious to our senses, and contained in proper vessels, blood and the fluids secreted from it; saying,—“There are others, more subtile, more active, and possessing the greatest efficacy and power of motion, which Hippocrates called *Impetum facientia*, and the antients, who were ignorant of the nature of invisible fluids, called *Spiritus*; because they cause motion, actuate the solids, and moderate and govern the course of the fluids (*Med. Rat. Lib. 1. Cap. 1.*).”—Galen called the *impetum facientia*, **SPIRITS**, and the gross fluids, **HUMOURS**. In a word, modern physiologists are content to speak of Solids and Fluids only: the *partes contentae*, and *partes impetum facientes*, and *spiritus*, being now-a-day comprehended in the word *fluids*. Other divisions of less moment may be

into *hard* and *soft*: the former comprehending bones and cartilages, the latter, muscles, viscera, and all the other soft parts of the body.

The Solids of the Human Body.

The solids of the human body are either *simple* or *compound*. The parts, which are called *firm*, or the *simple* solids, formed of earthy particles connected one to another, by an intermediate animal gluten, supply the principles of our body ⁽⁴⁾.

A *Simple Fibre* is composed of a series of such earthy particles joined together by gluten ⁽⁵⁾.

If

found in Bartholine (*Anat. Reform.*), Glisson (*Anatom. Hepatis*), and Haller (*Diff. Phys. Gott. Apr. 22. 1752.*)

(4) It is wrong to say that the most simple fibres consist of earthy particles joined together by intervening glue. For that glue may be formed of animal substance, is no proof that it existed, perfectly formed, in it. Haller even tells us that the earthy particles do not cohere by attraction, but by intermediate gluten (*Primæ Linææ Phys. § 4. 5. 6.*): and Macbride assigned the cohesion of all bodies to fixed air. But fixed air is no more to be considered a part of animal substance than gluten. Lastly, Dr. Cullen talks of the density and elasticity of the most simple fibre, as well as its cohesion, depending upon the proportion of water to the other concreting matter (*Instit. of Medicine*). In a word, the same objections are to be made to Doctor Cullen's opinion, as to those of Leber, Haller, Macbride, and others.

(5) Most physiologists agree, that the simple, solid fibre, like the line of the Geometer, consists of points, differing, however, from each other, because the points of the former are *physical*, but those of the latter imaginary. Haller extends the allegory, and says that, the parts of
the

If many simple fibres be connected together, by their breadth, they constitute a *Simple Layer*, or *Lamina* ⁽⁶⁾.

Cellular texture is formed by the union of many simple *laminae* ⁽⁷⁾.

When

the human body are made of fibres, as geometrical figures are made of lines. He says, that one Bernard Connor first taught that the whole animal body is made of fibres, more or less compacted together; but he refers to Herman Boerhaave, and his pupils, for the particular proof of such constitution in Bones, Cartilages, Membranes, Vessels, Ligaments, Tendons, Muscles, Nerves, Cellular Membrane, &c. (*Elem. Physiol. Tom. I.*).

It may be remarked also, that this is not the only meaning of the word *Fibre*; since Celsus, speaking of the Lungs, talks of their *Fibres*, where we would say, *Lobes*. His words are,—“*in duas fibras, ungulae bubulae modo, dividitur*”;—understand *Pulmo* (*Lib. IV. Cap. I.*)—The moderns, however, seldom, or never, use the term, to signify any thing different from that defined in the text. Those who are desirous to see the other significations of this word, may find them in Vossius's *Etymologicon Linguae Latinae*; and in Castellus's *Lexicon*.

(6) Though the word *Fibre* be generally confined to the signification of an extended, small, body, the length of which much exceeds the breadth; yet Haller says,—“Another kind of fibres is the *laminae*”—(*Prim. Lin. § VIII.*). Now as he spoke of the simple fibre, or that which is conceived, but not seen, and which is thought to exist, incapable of being divided into less fibres; so by the second kind of fibres, or the simple *laminae*, he does not mean the large ones of bones, but the smallest, perhaps, of the cellular membrane; or such as cannot be divided into less.

(7) According to Haller, the cellular membrane is composed of both kinds of fibres; of fibres, as we commonly say, and of his second kind, or *laminae*. He further observes, that there is a greater number of fibres than *laminae* in some parts; for example, the coat of the carotid

When cellular texture is more compact, it becomes a *membrane* ⁽⁸⁾.

The convolution of many membranes so as to form a canal, capable of containing the circulating fluids, suggests the idea of a *vessel*.

Thick, strong, and elastic membranes, are called *ligaments*.

Cartilage seems to be composed of a coagulated, elastic jelly, and a peculiar kind of fibre.

Bones are the most dry and hard parts of the human body: composed of fibres, which are insensible, firm, and fragile, together with an interposed terrestrial gluten, changed into coagulum.

Nerves appear to be soft bundles of fibres, arising by innumerable white, pulpy filaments, continued in a parallel direction; by the in-

artery, described by Lancisi, Hebenstreit, and others: whilst in some parts, such as the *epiphyses* of bones, and cellular membrane, the quantity of *laminæ* exceeds that of fibres.—I mention this, because it is the opinion of a great man; though I own myself ignorant of any good that can possibly arise from knowing it.

(8) So Haller thought, and said, that cellular substance is changed into membrane, by mere pressure; and that membrane again becomes cellular substance, by relaxation. He conjectured likewise, that tendons, cartilages, and every part of an animal is made of cellular membrane. It seems strange, how he could have inferred this of cartilage: but, he says, the cartilage of adult persons and children, especially that of their ribs, is gradually resolved into *laminæ*; that is, into his second kind of fibres: which, I imagine, Professor Leber means, by "*singularis fibrarum species*."

tervention

tervention of which, sensation and motion is performed.

Muscles are organical parts destined for animal motion, composed of nerves, fibres, arteries, and veins.

Tendons are the beginnings or ends of muscles, of a colour somewhat like that of silver; but, in the latter, the fibres are firmer, stronger, and nearer together.

Glands are organized parts, rather compact, round, or oblong, contained in a proper membrane, composed of arteries, veins, and nerves, and intended for the secretion or change of some determinate fluid.

Viscera are organical parts, composed of vessels, nerves, glands, secretory, and excretory ducts, cellular texture and membranes ⁽⁹⁾.

An *Organ*, or *organical part*, is any part of a living body, which performs a determinate office.

The Fluids of the Body.

Before the *fluid* parts of the human body are separately examined, it will not be amiss to premise a compendious survey of the *Animal Oeconomy*.

As soon as food is taken into the mouth, divided by the teeth, and chewed and mixed with spittle and air, it is carried into the cavity of the *fauces* and *pharynx* by the action of the muscles of the tongue, the *os hyoides*, &c. and from thence through the *oesophagus*

(9) For more accurate definitions, and histories, of these parts, the reader may consult the sequel.

into the stomach. But it is necessary that solid and fluid aliment, before it pass into the hollow of the *pharynx*, should be carried over the opening of the top of the *aspera arteria*, which is situated before the *pharynx*: hence Nature hath ordained, that the *epiglottis* shall cover the *trachea*, and exactly close it; serving, as if it were a bridge for meat and drink, passing over the aperture of the *trachea*; lest they should fall into it, and excite the danger of suffocation.

The food being carried into the stomach, and diluted with the saponaceous bile and pancreatic juice, is again attenuated and dissolved by the fluids of the intestinal canal, and its peristaltic motion. What is mucilaginous is diluted, and that which is oily is mixed with that which is watery; so that a white, milky liquor is at length extracted, which is called *Chyle*. This chyle is absorbed by the very numerous ends ⁽¹⁰⁾ of lacteal vessels, opening into the cavity of the small intestines: the remaining thicker part of the aliment, from which the chyle has been absorbed, being propelled into the large intestines, to be evacuated from the body through the *anus*, by the peristaltic motion. The lacteal vessels convey the chyle, which they have absorbed, into the lymphatic glands of the mesentery; where it is attenuated and diluted by lymph, brought

(10) It will be found hereafter, that Leber had spoken more properly, if he had said, *by the very numerous beginnings*, instead of *ends* (*à copiosissimis finibus, &c.*) of lacteal vessels,

there from the inferior parts of the body. Out of these glands of the mesentery, the chyle is carried to the *Lumbar Cistern*, and lastly to the *Thoracic Duct*: the superior part of which is inserted into the left subclavian vein, into which the chyle is poured from the duct already mentioned.

The chyle thus mixed with the blood, descends into the right ventricle of the heart; and is thrown out of it, together with the blood, by the contraction of this ventricle, into the trunk of the pulmonary artery, its branches and minute ramifications; which are dispersed throughout the lungs. Then the chyle is intimately mixed with the whole mass, partly by the action of the vessels themselves, and partly by the movement of the circulating blood: hence it is rendered fit to nourish the body by supplying the wasting of all the fluids, in the secretory organs.

Now the air of the atmosphere, which is inspired and expired alternately, by the mechanism of respiration, seems to conduce much to the completion of those charges in the chyle and blood, which have already been mentioned. For, during inspiration, air expands all the branches of the *bronchia*, and the air cells; and consequently, the lungs are every way expanded, the blood-vessels elongated, and their pressure against one another lessened: so that the blood circulates through them more freely. But, during expiration, the lungs become smaller and more contracted,
all

all the vessels are drawn into more acute angles, and are necessarily more compressed ⁽¹¹⁾. The motion of the blood too, which before was free, now becomes slow and difficult, and continues so, till its greater accumulation in the right ventricle of the heart and trunk of the pulmonary artery obliges us to inspire again. Hence it appears manifest, how necessary fresh portions of the most pure and wholesome air are to the formation of blood,

(¹¹) Leber seldom differs in opinion from Haller, who also asserts that the blood vessels of the lungs are elongated, their diameters enlarged, and their angles so changed, by inspiration, as to render the circulation of blood through the lungs free; but that, in expiration, the lungs are contracted in all directions; and even that the angles of the blood vessels become more acute, shorter, and of smaller diameter: so that the blood which before was freely moved, is now moved slowly and difficultly, or not at all, till forced by the pain, one is led to inspire, to renew the dilatation of the lungs (Haller *Pr. Lin.* § CCLXV. or *El. Phys. Lib.* IV. S. 4.) Now this reasoning is certainly fallacious. For though it be admitted, that the *bronchia* and blood vessels of the lungs are extended in inspiration, and contracted in expiration; as the lungs themselves are also extended and contracted; though it be admitted, that an accumulation of blood do take place, on the right side of the heart, in expiration; from the slower circulation of blood through the pulmonary vessels, yet Haller undoubtedly contradicts himself, by saying that the angles formed of the vessels of the lungs are rendered more or less acute in the different states of respiration, by alledging that the lungs are augmented or diminished; but that their form continues the same. For it is as plain as any proposition of Euclid's, that if the lungs be enlarged, or contracted in all dimensions, the *bronchia* and blood vessels will have the same *ratio*. (Goodwyn's Inquiry on Drowning, &c.)

and

and the consequent establishment of health. Beside, there escape from the blood of the lungs, in expiration, many volatile, watery and putrescent particles. Lastly, air seems to contribute, in a great degree, to the red colour of the blood.

Blood, formed in the lungs, in the manner now described, is a liquor seemingly homogeneous, of a red colour, and coagulable; becoming of a more glowing purple, as the body from which it is effused is more healthy, and supported with better nutriment ⁽¹²⁾. This
very

(12) Though Human Blood, moving in the arteries and veins, appears upon inspection to be a homogeneous fluid: yet, if viewed through a microscope, it appears manifestly to consist of red particles floating in a transparent, colourless *medium*.

Blood is more *Fluid* in the arteries than in the veins, and in the veins than in the right ventricle of the heart, the *corpora cavernosa* of man, the *clitoris* of woman, and perhaps the *sinuses* of the brain.

As to its *Heat*, in man, it never exceeds 112°, and it is never less than 30°, of Farenheit's thermometer. But in different persons, and in the same person at different times, the heat of the blood is very different. The heat of the blood, and of man, is nearly the same in summer and in winter. Whatever quickens the pulse, augments the heat also.

The *Colour* of the blood depends upon the red particles. The blood of the arteries being thinner, it is also more florid than that of the veins.

When blood is effused from the vessels of a living body, and received into a basin, it begins after three or four minutes to coagulate, and in seven or eight minutes it is entirely coagulated. There is, however, some variation in the time of coagulation; it always takes place the sooner in proportion as the action of the
blood

very blood, is brought back by the pulmonary veins into the left ventricle of the heart;
from

blood vessels is the slower, and as the person, from whom it is effused, is the weaker.

Blood always coagulates in the vessels of dead bodies, sooner or later, according to the circumstances of dying: except in certain cases of very sudden death, from lightning, electricity, a blow on the stomach, &c. Animals killed in the chase have their blood not coagulated.

The quantity of blood in an animal body is difficult to be ascertained. Most physiologists agree that, in an adult, the quantity is nearly equal to thirty pounds; and that the sum of all the circulating fluids is at least equal to fifty pounds. So that the quantity of fluids in an animal body is far greater than of solids. The quantity of blood effused is not so much the cause of fainting and of death, when fainting and death follow a loss of blood, as the manner in which the blood flows. For, if it flow slowly, and from a small orifice, it is surprizing how much blood may be extracted, without fainting: but, on the contrary, if blood flow quickly, and from a large orifice, faintness supervenes while the quantity effused is but inconsiderable; and, if a large quantity of blood be very suddenly withdrawn, death is the inevitable consequence. This, which is so easily put to the test of experiment on brutes, depends upon the necessity which there is for the blood-vessels to accommodate themselves to their contents. And, it is impossible for the blood-vessels to contract and adapt themselves to their contents, if their contents be suddenly decreasing. For a certain plenitude of the vessels is necessary to keep the functions of life entire, and to preserve health. Hence, if we would induce faintness, to stop hæmorrhages, and to lessen and destroy inflammation, we should let blood by a large orifice.

In about ten, or eleven, minutes, the blood being coagulated, a fluid oozes from every part: the jellied or coagulated part contracts, and recedes from the sides of the vessel, and after some interval, is surrounded by the fluid separated from it. The coagulated part, or *Craſſamentum*, is nearly equal in bulk to the fluid in which it

from whence, it passes into the *aorta*, and from the *aorta*, to every part of the body; where

is immersed; but in strong persons the proportion of *crassamentum* to the fluid part, or *serum*, is greater than in weak persons (See Cullen's Mat. Med. Vol. 1.)

This separation into *crassamentum* and *serum* is retarded, and prevented by cold. Cold also impedes and prevents the coagulation of blood. Mr. Hewson caused blood to freeze, whilst contained in the veins; and he found that, when thawed, it jellied and separated into *crassamentum* and *serum*, as if it had never been frozen (An Experimental Inquiry into the Properties of the Blood, Exp. V. Edit. 2.). He also found by experiment, "that the separation of the blood in a given time, is in proportion as the heat in which it stands is nearer to the animal heat, or 98° , or greater in that heat than in any of a less degree (p. 5.)."

Serum, separated spontaneously from the rest of the blood, is fluid in the heat of the atmosphere, transparent, yellowish, and in specific gravity to water as 1030 to 1000 (Dr. Jurin's Exper. Philos. Transf. N^o 361.). Its taste is saltish.

It coagulates at 160° , and when coagulated, it resembles the white of an egg. The gastric liquor coagulates *serum*: Acids, Alcohol, and Essential Oils coagulate it. But none of these, when taken by the mouth, passes so concentrated into the blood-vessels as to coagulate the blood in them.

If *serum* be exposed to a heat below 160° , but equal to 100° ; it is gradually inspissated into a brownish, solid mass. And, if the fluid evaporated be condensed, collected, and added to the inspissated *serum*, it will dissolve it, and form fluid *serum* again; possessed of all its former properties. If, instead of the fluid collected by distillation, water be added to inspissated *serum*, the same follows.

If *serum* be diluted with water, it is not coagulable at 160° , nor at 212° (Hewson, p. 138.). But if the mixture be evaporated, coagulation begins as soon as the superfluous

where different liquors are separated from it, according to the various nature of the parts and

superfluous water is exhaled ; a pellicle being formed on the surface, which becomes thicker by degrees as the evaporation is continued. This pellicle cannot be dissolved in water, like inspissated *serum*: Mr. Hewson says, it seems to be a mucilage coagulated.

If we press *serum* coagulated by heat, a fluid escapes from it, which Senac calls *Serocity* (*Traité du Cœur.*). The salts of the blood are said to be contained in this serocity. Serocity is not coagulated at 212° , unless a part of its water be evaporated.

If it were not for the salts of the *serum*, it would probably congeal, as water does, at 32° . But *serum* congeals only at 28° .

Crassamentum consists of two parts, easily separable from each other, viz. what is called the fibrous part of the blood, or *Gluten*, or *Coagulable Lymph*, and red particles.

To effect the separation of these two, from each other, one needs only to wash the *crassamentum* with water ; for during the washing, the red particles will be carried away, and the coagulated lymph will remain behind.

Coagulable Lymph, as long as it continues in circulation, is fluid at any degree of heat between 30° and 120° . Its point of coagulation is, perhaps, between 114° and $120\frac{1}{2}^{\circ}$. It cannot be coagulated by disease, for febrile heat never exceeds 112° .

Some have imagined that coagulable lymph and *serum* are the same ; because if mixed with some of the neutral salts, coagulable lymph does not coagulate in the temperature of the atmosphere. But Mr. Hewson found that coagulable lymph mixed with Glauber's salt, coagulates at 125° , whereas *serum* does not coagulate, except at 160° (Hewson, Exp. VII.). Coagulable Lymph, even if mixed with a neutral salt, cannot be inspissated, and dissolved again, without coagulation (Hewson, p. 137.). The smaller the vessel, from which coagulable lymph is taken, the longer it is in coagulating.

Whenever

and *viscera*. Of these secreted liquors, those that are useless are evacuated from the body ;
but

Whenever the action of the blood-vessels is quick and strong, the blood is rendered more fluid and flow of coagulating. Faintness and languor, which render the blood more viscid, increase its tendency to jelly. Hence, when the vascular system is much excited, and when the coagulable lymph is attenuated, and its tendency to coagulate is lessened, the red particles have longer time to subside, through it; and, accordingly, the coagulable lymph appears free from red particles, and coagulated on the surface of the *crassamentum*. If the blood of a pleuritic person be continually agitated till it is coagulated, the coagulable lymph will not be separated from the red particles; consequently, there will be no coagulable lymph on the surface of the *crassamentum*.

Patients labouring of inflammatory disorders have the coagulable lymph very much attenuated: of consequence, when their blood is exposed to the air, the thinness of the lymph, and its slowness of coagulating, allow the red particles to sink to the bottom of the vessel. The coagulated lymph, thus freed from red particles, on the surface of the blood of patients having inflammatory diseases, is called the *Crust, Size, or Buff*, of the blood.

It is the coagulable lymph, which, when solid, gives firmness to the *crassamentum*.

The Cause of the Coagulation of the Lymph, when effused into a basin, is not known. It has been attributed to rest. But if you agitate blood with a stick, it will coagulate. Mr. Hewson attributes it to the Air (p. 20, 21.); but when blood is effused into the cellular membrane, it coagulates, forming *ecchymoma*. It coagulates also in dead bodies. Another cause, and to which it has been assigned, is cold. Cold certainly thickens the blood, but it lessens its disposition to coagulate; and, if long continued, altogether prevents it. Mr. Hunter believes the blood to be alive, and considers its coagulation as depending on its life.

Red Particles. The red particles of the blood were so generally allowed to be spherical, before the time of
our

but the useful ones, and those that are requisite for nutrition and the purposes of the animal œconomy, are retained.

The

our countryman Mr. Hewson, that in almost all books on the blood, they are called *Globules*. Mr. Hewson, however, says, they are as flat as a guinea, and have a dark spot in the middle, which spot was mistaken by Father de la Torr  for a hole. Mr. Hewson, the better to ascertain the figure of the red particles, coloured a quantity of *serum* with a piece of the *crassamentum*, and spread a little of the coloured *serum* on a thin glass plate. And he says, that, when this thin glass plate is placed horizontally in the microscope, but somewhat higher at one end than at the other, the red particles will descend from the higher to the lower part of the glass plate, together with the *serum*, some gliding along on their flat sides, and others turning from one side to the other. The celebrated Senac says, the particles of the blood are lenticular (*Traité du Cœur*).

Mr. Hewson believed the black spot to be a solid particle. For having dropped a drop of blood on a thin glass plate, and added drops of water to it, he saw that, in proportion as he added water, the particles became more spherical, their longest diameter was shortened; and, as they rolled, the solid middle particles were distinctly seen falling from side to side in the hollow vesicle, like a pea in a bladder. Sometimes he saw the particles sticking to one side of the vesicle.

As the red solid particle occupies the middle only, the edges, according to Mr. Hewson, are either empty, or contain a subtiler fluid. Mr. Hewson saw the vesicle burst, and the red particle fall out of the fissure.

That the use of the salts of the blood is to preserve the figure of the vesicles, to keep the blood fluid, and fitter for circulation, is deduced from the effects of water, which changes the figure of the vesicles, renders them thinner and more transparent, and at length dissolves them.

The

The Chemical Principles of the blood are a volatile watery phlegm, coagulable lymph,

The size of the red particles, vesicles, or globules, or whatever they are, is said by Dr. Jurin to be about the 2000th part of an inch (Phil. Transf. No. 361), and by Haller to be between the 2000th and 3000th part of an inch (*Primae Lineae Physiologiae* § 145). But Hales and Senac have thought it much less.

There are more red particles in strong than in weak animals.

The opinion of Lewenhoeck, and of Boerhaave (*Institut. Med.* § 226.) was, that the red particles are globular. They averred that each red globule is composed of six yellow serous globules; and that each yellow serous globule is composed of six pellucid lymphatic globules. So that, according to them, each red globule is formed of thirty-six lymphatic globules. Gaubius very properly objected to this opinion: he could not imagine how six yellow globules can make one red one (*Inst. Pathol.* § 341.). I believe this opinion is now-a-day totally laid aside; but it deserved to be mentioned, as being the foundation of Boerhaave's system.

Dr. Hales found that thirty-three parts of the blood are true air (Veget. Stat. Exp. 49.). But he separated this air by distillation. Therefore, it affords no proof of air ever being loose and uncombined in the blood-vessels. Indeed it is certain there is no air floating in the blood: since, if you puncture an artery, or a vein, under water, not a particle of air escapes and ascends (Philos. Transf. 1774.).

The blood is sometimes of a milky appearance. This the older physiologists had assigned to unassimilated chyle: Mr. Hewson derives it from the absorption of oil out of the cellular membrane (Exp. Inq. Part I. p. 141.); and his chief reason is, because in dissecting geese, the chyle of which is transparent, he often saw the same. But as this appearance may so very often be seen in blood drawn soon after eating; and as animal oil sinks in *serum*, and does not swim, like chyle, it seems to me that the older opinion is right (note 455.).

VOL. I.

C

oil,

oil, alkali both fixed and volatile, marine salt, alkaline earth, together with a large quantity of air, and a little iron ⁽¹³⁾.

The principal liquors separated from the blood are these: viz.

- a. *Earwax*, in the Ears.
- b. *Tears*, in the Lachrymal Gland.
- c. *Spittle*, in the Salival Glands of the Mouth.
- d. *Mucus*, in the mucous glands of the Nose, Mouth, Intestines, *aspera arteria*, &c.
- e. *Gastric Liquor*, which is analogous to spittle, in the Stomach.
- f. *Bile*, in the Liver.
- g. *Pancreatic Liquor*, which is like spittle, in the Pancreas.
- h. *Urine*, in the Kidneys.
- i. *Seed*, in the Testicles.
- j. *Fat*, in the Adipose Membrane, and particularly, the *Omentum*.
- k. *Synovia*, or the *Haversian Liquor*, in the Joints.
- l. *Milk*, in the Breasts; which differs not from Chyle, except in being more elaborated.
- m. *Perspirable Matter*, *Sanctorian*, *Perspirable*, or *Insensible Transpirable Matter*, in the skin. When this is more sensible, or in greater plenty, it is called *Sweat*.

(13) The Chemical Analysis of the Blood, as well as of the fluids separated from it, shall be given at large in another work, if nothing prevent it. But the natural history of the fluids mentioned in the text shall be given in their proper place; viz. Of Earwax, in the chapter on the Ear; of the Tears, in the chapter on the eye, &c.

O S T E O L O G Y.

OSTEOL^{OGY} is that part of Anatomy which explains the doctrine of the Bones. Bones are considered either when free from all the surrounding soft parts, or when some of the soft parts are preserved and connected with them.

Osteology, therefore, is divided into *Dry* and *Recent*. We shall treat of the former, at present, postponing the latter, because the time, allotted for teaching this subject, requires it.

The *Object* of *Osteology* are Bones, whether taken apart, or dry, and joined together artificially; or when recent, and connected by their natural ligaments, as well in the infant, as the adult state.

Now, a *Bone* is described as the hardest, most compact, most inflexible, and most insensible part of the body ⁽¹⁴⁾, formed of many

(14) Consult the Recent Osteology.

small *lamellae*, which are themselves formed of rigid fibres, placed very closely against one another, in a certain manner.

When the *Elements of Matter* are placed next one another, in a longitudinal series, *bony fibres* are made. When bony fibres, like these, are adapted one to another laterally; they constitute *bony lamellae*; between which a gluten is effused, and gradually coagulated. The *Formation of Bones* consists in these circumstances. That spot, in which the formation of bone is first evident, is called the *Point of Ossification*.

Bones are neither formed of membranous nor of cartilaginous fibres, but of those earthy particles which always constitute the fibres of bones, and not the softer ones of cartilage, tendon, muscle, &c.

The *Lamellae* which are formed, differ one from another, in length, breadth, and thickness, and in levity and strength, according to the different position and number of bony fibres, concurring to make them. These *lamellae*, placed one over another in layers, are also conjoined by means of very numerous, irregular eminences, and lateral processes⁽¹⁵⁾,
which

(15) I have here translated *Claviculi, Little Processes*, after the example of Dr. Monro, (*Anat. of the Human Bones*). These small processes, which Gagliardi first thought of, and called *Claviculi*, as I suppose, to render his hypothesis easy, are said by him to be readily discovered

which arise from the surface on both sides. The diversity of bones, and their threefold substance, may be deduced from this structure.

Bones differ one from another not only in length, but also in figure. Some are long, and others are short: some are cylindrical, some flat, crooked, round, possessed of angles, or having a form altogether indeterminate. Besides, there are eminences, depressions, furrows, and cavities, in the surface of bones; and the last of these are present in the *medullum* of most bones.

There are two kinds of *Eminences*, the one is called *Apophyses*, and the other *Epiphyses*.

By the name *Apophyses*, or *Processes*, is understood, prominences continued from various parts of bones, which grow together with the bones, and are not separable from them by boiling.

Epiphyses are eminences attached to the ends, or sides of bones, by means of *periosteum* and cartilage; for which reason *epiphyses* are separated from bones by boiling. In infants the *epiphyses* adhere loosely: they are

vered in the bones of the *cranium*, after their being boiled, burned, or exposed to the open air a long time. He distinguished them, according to their direction, into *perpendicular* and *oblique*, and from their figure into *capitati*, or *headed*, and *ad angulum retorti*, or *crooked*. (*Anatomie Ossium Novis Inventis Illustrata. Cap. 1. Obs. 2.*). Malpighi thought him mistaken; and modern anatomists think as Malpighi did.

soft, and somewhat of the same nature as cartilage ⁽¹⁶⁾.

Prominences, like these, are variously denominated, according to their figure, situation, direction and use.

Processes extended from the end of a bone, if smooth and round, are called *Heads*: but they are called *Condyles*, when flattened, either above, or laterally. That part, which is beneath the head, and which exceeds the rest of the bone in smallness and levity, is called the *Neck*. Rough, unequal processes are called *Tuberosities*, or *Tubercles*; but the longer and more acute are called *Spinous*, or *Styloid Processes*, from their resemblance to a thorn. Thin, broad processes, with sharp extremities, are known by the name of *Cristae*, or *Sharp Edges*. Other processes are distinguished by their form, and called *Alar*, or *Pterygoid*, *Mammillary*, or *Mastoid*, *Dentiform*, or *Odontoid*, &c. Others, from their situation, are called *Superior*, *Inferior*, *Exterior*, and *Interior*. Some have their name from their direction, as *Oblique*, *Straight*, *Transverse*, &c. And some from their use; as *Trochanters*, or *Rotators*, &c. &c.

Furrows, Depressions, and Cavities, are destined either for the reception of contiguous bones, to form an articulation with them,

(16) *Epiphyses*, therefore, become a kind of *Apophyses* by age. Kulm relates the case of the body of a girl that he dissected, in which, though she had passed the sixteenth year, all the *epiphyses* were seen connected by cartilage. (*Tab. Anat. p. 62.*)

when

when they are called *Articular Cavities*, which are sometimes deeper and sometimes shallower; or they receive hard parts, but do not constitute a joint with them.

Moreover, cavities serve for the transmission and attachment of soft parts.

Various names are given to depressions and cavities, according to the magnitude and figure of bones. If they be broad and large at the beginning, and not deep, but contracted at the end, they are called *Pits*. *Furrows* are open canals extending longitudinally in the surface of bones. A hollow, circular tube, for the most part of the same diameter, from beginning to end, and more or less crooked, straight, long, or short, is named a *Canal*. *Foramina* are the apertures of canals, or they are formed of the excavated margins of two bones, placed against each other. If such be the form of the margin of a bone, as if a portion were taken out of it, we call it a *Notch*, or *Scollop*.

Besides these, there are mucilaginous cavities and labyrinths in bones, which we shall speak of on another occasion: but it is not worth while to take particular notice in this place of those unequal parts of bones, called *Inequalities*; though some authors have done it.

The *Colour* of dry bones depends on the skill of the preparer. They are sometimes very white, and sometimes inclining to yellow. What relates to the natural colour of the recent bones, compared with one another, and considered according to

the diversity of age, will be spoken of in a more fit place, the *Recent Osteology*.

The *Substance* of bones is of two kinds. If the fibres and *lamellae* cohere very firmly, and are placed one upon another, the substance is more compact, dense, and firm; and it is this substance that constitutes the external part of every bone. It is most plentiful in the middle, or body of cylindrical bones; less plentiful in the extremities; and it encompasses the greater part of flat bones with a thin coat: but, where the interstices are more remarkable and intercepted by those fibres and *lamellae*, or where particular cavities are formed, there the substance of bones is rarer. This rarer substance of bones is also of two kinds; for when the fibres separate from the bony *lamellae*, they are bent and interwoven one with another, in various directions, so as to resemble a kind of sponge, called *Cellular*, or *Spongy Substance*. Another kind of substance is the *Reticular*. This is found in the *medullium* of cylindrical bones, and is made up of small, long, bony fibres, which intercept manifest interstices, decussate one another, and constitute a kind of net-work.

Thus, the longer bones consist of three kinds of substance; of which the first is dense, firm, and *compact*; the second is *cellular*, or *spongy*; and the last is *reticular*.

Internally in bones, there are large cavities, small receptacles, cells, and different *foramina*.

The larger cavities may be seen throughout the whole length of cylindrical bones; in which the compact substance is turned into a long and great canal. There are cells in all bones, either long or short, circular, oval, &c. As to *foramina*, they are the orifices of canals, or they are as small as the pores of the skin.

If all the bones proper to the body be joined together, in the natural order, they form a *Skeleton*. When the bones are connected by wire, the skeleton is said to be *artificial*: it is called a *Natural Skeleton*, when, instead of metallic means, the bones are preserved in their proper place by the natural ligaments ⁽¹⁷⁾.

A *Skeleton* is divided into three parts; viz. its *Head*, its *Trunk*, and its *Extremities*.

The *Head* is composed of the Skull and the Bones of the Face.

The Skull is made up of eight bones, the foremost of which is the *Os Frontis*; the hindermost the *Os Occipitis*. The two *Offa Parietalia* form the superior lateral parts; and the

(17) Each of these Skeletons has its particular use; both being necessary in teaching and learning Anatomy. The *Artificial Skeleton*, if rightly prepared, suffers no change by being kept, destructive of its original form, or productive of inconvenience: but the *Natural Skeleton* loses its form, and is only useful whilst fresh. For, in keeping it a long time, the marrow, and other parts, disposed to spontaneous change, exhale an odour alike ungrateful and unwholesome, and exude a greasiness irreconcilable to the touch. Moreover, the ligaments and cartilages become dry, shrink, and lose their original figure; and even hide parts which ought to be shewn. Lastly, the colour of fresh bones is changed by keeping them.

two *Ossa Temporalia*, the inferior lateral parts. Under the anterior part of the *Os Frontis*, is placed the *Os Ethmoideum*; and under the inferior part the *Os Sphenoideum*.

The four little bones of the Ear are contained in the petrous portion of the *Ossa Temporum*: their names are *Malleus*, *Incus*, *Stapes*, and *Ossiculum Orbitale*. There are also frequently, between the sutures of the cranium, small bones, called *Triquetra*.

Anatomists divide the *Face* into the *Upper* and *Under Jaw*. The Upper Jaw consists of thirteen bones; two *Ossa Maxillaria*, two *Nasalia*, two *Lachrymalia*, two *Jugalia*, two *Palatina*, two *Spongiosa Inferiora*, and the *Os Vomer*.

The Under Jaw of an adult is only one bone.

The Face, therefore, consists of fourteen bones, six of which are pairs, two are not.

Thirty-two Teeth are naturally implanted in both jaws, sixteen in each.

The head, therefore, contains sixty-two bones, as appears from adding them all together. And, if the *Os Hyoides* be enumerated with them, the head is composed of sixty-three bones.

All the bones are referred to the trunk, except those of the head, and those of the superior and inferior extremities; so that it consists of the *Spine*, *Thorax*, and *Pelvis*. The Spine is subdivided into its twenty-four *True Vertebrae*, viz. seven of the neck, twelve of the back, and five of the loins.

The

The *Pelvis* is composed of four bones; viz. the two *Ossa Innominata*, the *Os Sacrum*, and the *Os Coccygis*. The two latter are distinguished by some, under the name of *False Vertebrae*.

The *Thorax* is made up of twelve ribs, on each side; the seven superior of which are called *True Ribs*, and the inferior five, *False*; all of them being fastened to the *vertebrae*. Anteriorly, is the *Sternum*, which consists of two parts, together with the annexed *Xyphoid Cartilage*, at its inferior extremity. Hence, the *thorax* consists of twenty-six bones, and the entire trunk of fifty-four.

There are four extremities. Two *superior*, which are connected to the sides of the *thorax*; and two *inferior*, affixed to the lower part of the *ossa innominata*. The former are called *Arms*; the latter *Legs* and *Thighs*.

The *Superior Extremities* are divided into

1. The *Shoulder*, which is composed of the *Scapula* and *Clavicle*;

2. The *Arm*:

3. The *Fore-arm*, which is formed of the *Radius* and *Ulna*:

4. The *Hand*, consisting of the *Carpus*, *Metacarpus*, and the five *Fingers*.

The *Carpus* is composed of eight little bones: viz. the *Os Naviculare*, *Os Lunare*, *Os Cuneiforme*, *Os Pisiforme*, *Os Multangulum majus*, *Os Multangulum minus*, *Os Magnum*, *Os Unciforme*.

The

The *Metacarpus* consists of five bones only.

The *Five Fingers* are made up of fourteen bones, two of which belong to the thumb; and there are three which concur to form each of the four fingers: viz. the *Fore-finger*, the *Middle-finger*, the *Ring-finger*, and the *Little-finger*. The series of bones belonging to each finger, is distinguished by the appellation of a *Phalanx*. Besides the bones already mentioned, there occur almost always two little bones, between the first bones of the *metatarsus* and the thumb, called *Sesamoidea*, which are sometimes found in the hand, but seldom, if ever, between the *Os Femoris* and *Tibia*.

The number of bones then belonging to the superior and inferior extremities being the same; the entire number belonging to the Skeleton of an Adult, as appears from what has been said, is as here represented :

The Bones of the	{	Head, together with		
		the <i>Os Hyoides</i>	-	63
		Trunk	-	54
		Superior	} Extremities	64
		Inferior		64
The whole				245

The *Use of the Bones* is, to serve for the defense, direction, and support of all the parts of the body.

The

The *Connection of Bones* is illustrated in the two following tables. The connection of bones being either *moveable* or *immoveable*, the one table represents the *moveable connections*, the other the *immoveable connections*.

T A B L E I.

Moveable Connections of Bones ⁽¹⁸⁾.

ARTICULATION is a moveable connection of bones, when two bones joined together may be moved *to* and *from* each other.

I. Ar-

⁽¹⁸⁾ All agree that a knowledge of the different kinds of articulation is a necessary part of Anatomy. Some, nevertheless, dissuade persons from it, by alledging that it is diffuse, complicated, and, consequently, difficult to be attained. I have never been so unlucky as to labour under any perplexity in acquiring it; and am persuaded that the difficulty complained of by others, arose from their fearfulness to attempt, or officiousness to condemn. The following tables illustrative of the manner in which the various conjunctions of bones are made, are compendious, full, and clear. They differ, indeed, from those which Leber had given; but the difference is small, and serves one good end, which is, to prevent the repetition of the several examples which must otherwise have necessarily been made.

Professor Leber considers an articulation as the union of the extremity of one bone to the extremity of another; whether the two bones can be moved upon each other, or not. He divides the moveable connection into three kinds: viz. *Diarthrosis*, where there is obvious motion; *Synarthrosis*, where there is obscure motion;

I. Articulation with sensible motion is called *Diarthrosis*.

There

tion, and *Amphiarthrosis*, where the motion is imperceptible.

Diarthrosis is subdivided into *Enarthrosis*, in which the great head of one bone is received into, and moved in the deep cavity of another : for example, the head of the *Os Femoris* in the *Acetabulum* : *Arthrodia*, when the round head of a bone is received into a cavity of less depth ; e. g. the Head of the *Os Brachiale* into the cavity of the *Scapula* ; and *Ginglimus*, where the bones receive and are received by each other, and when their motion is reciprocal on each other. *Ginglimus* is again divided into *Angular*, when one bone in moving makes an angle with another ; e. g. the *Ulna* with the *Os Humeri* ; and *Lateral Ginglimus* where the motion is lateral, as it is between the *Radius* and *Ulna*, or the first and second *vertebrae* of the neck. The motion in *Ginglimus* is like that of a hinge.

We have an instance of *Synarthrosis*, between the Carpal and Metacarpal, and the Tarsal and Metatarsal bones.

Amphiarthrosis is such motion as occurs between the bones of the *Carpus* or *Tarsus*.

So much for Articulation with motion. We come next to speak of articulation without motion, which is called *Symphysis*.

The first division of *Symphysis* by Prof. Leber is, into *Mediate*, in which there is scarcely any motion, but where something is included between the bones ; and into *Immediate*, where nothing is interposed, but where the connection is firm and incapable of motion.

Mediate Symphysis is called *Synchondrosis*, if cartilage be interposed ; e. g. the ribs and the *sternum* : *Synneurosis*, or *Syndesmosis*, or *Syntenosis*, or *Synemesis*, if Tendon or Ligament ; e. g. between the *Os Sacrum* and *Os Coccygis* : and *Syffarcosis*, if bones be united with muscle ; e. g. the *Os Hyoides* with the *Sternum*, or the *Scapula* with the ribs.

Immediate

There are three kinds of Diarthrosis : viz.

1. *Enarthrosis*,
2. *Arthrodia*,
3. *Ginglimus*.

Ginglimus is again distinguished into *Angular* and *Lateral*.

II. Articulation with obscure motion is called *Synarthrosis*.

III. Articulation with insensible motion is called *Amphiarthrosis*.

Immediate Symphisis is called *Harmony*; e. g. between the bones of the nose : or *Suture*, which is *true* or *false*, as in the bones of the head : or *Gomphosis*, when one bone is fixed in another, as the teeth in their *alveoli*.

Here the doctrine of the Connection of bones is rendered easy. Those who are desirous to learn it, as described by others ; or, to learn the different acceptations of the words above cited, must not wonder if they should find authors differing, and giving meanings to terms, which Etymology does not authorize. It is for this reason, that I have refrained from adducing the Etymology of the connections ; for after inquiring into the proper meanings, and consulting antients and moderns, I was convinced that it was not only unnecessary, but improper ; because it would frustrate my original design, which was to be short and easy.

TABLE II.

*Of that Articulation of Bones, which is
without Motion.*

I. <i>Symphysis</i>	Mediate	{ <i>Synchondrosis</i> <i>Syneurosis</i> <i>Syssarcosis</i>	
	Immediate	{ <i>Harmony</i> <i>Suture</i> <i>Gomphosis.</i>	{ <i>True</i> <i>False</i>

The Bones of the Head.

We have already divided the head, which is the uppermost part of the skeleton, supported by the first *vertebra* of the neck, into the *Skull* and *Face*: and we have likewise enumerated all the bones, of which the head is composed, in proper order.

As to the *Figure of the Skull* ⁽¹⁹⁾ it is like an irregular, hollow sphere, arched anteriorly, and

(19) The skull of an infant is more like a sphere than that of an adult. The reason of which is obvious. Its form depends altogether on the equal and uniform pressure of the brain, on the bones of the skull not being ossified, and the muscles contiguous to them not having acted. For, as the bones of the skull become firmer, the enlargement of the brain is more counteracted; and as the strong

and on its upper and posterior parts. It is flattened on each side, and is smooth but unequal on its under part. It consists of the eight bones of the *cranium*. The bones of the face rather resemble a triangle.

The *Magnitude of the Head*, in a well formed man, is in proportion to the rest of the body as One to Nine ⁽²⁰⁾.

It

strong muscles of the Temples are made to act more, so the temples are more flattened.

But, independent of these natural causes, which prevail in all persons, Dr. Camper has endeavoured to prove that there are others, though unknown at present, which effect some characteristic mark in the configuration of the skulls of different nations. I believe, Vefalius was the first who made mention of this circumstance. Instead of attributing it to certain unknown natural causes, he thought it depended on a peculiar management of the heads of children, in early infancy. He imagined that the Head of a Turk was more spherical, and that of an Englishman more flattened; because the former had worn a Turban, and the latter a Chin-stay (*De Humani Corporis Fabrica. Lib. I. Cap. 5.*). It is hard to settle this matter, we leave it therefore for the discussion of others. There is something, however, that distinguishes the head of a Negro from that of an European, which cannot be referred to any early pressure; but must depend on causes of which we are ignorant, and perhaps shall always remain.

⁽²⁰⁾ The head of a *foetus* differs from that of an adult, both in its proportion to the rest of the body, and its figure. Hervey observed that the head of a *foetus* is larger than its whole body. Haller says the same (*Prima Lineae Phys.* § 889.). Ruysch says that, about a month after conception, the entire man is scarcely any thing except head and tail (*Thef. Anat. VI. Tab. II. Fig. I.*): and Blumenbach says, that the lower jaw and some of the bones of the face begin to be formed about the

It deserves attention, that of the different parts of the head, the superior and middle part is called *Vertex*; the inferior part, *Basis*; the two anterior, lateral and flat parts, *Temples*; the anterior part, the *Face*; the posterior part, *Occiput*.

The *Substance of the bones of the cranium* is made up of two layers, or, a double, firm, and compact substance; the exterior of which is thick, smooth, and covered with *pericranium*: the interior layer is thin and unequal, but stronger than the former, and covered with *dura mater*. This latter *lamina* is called the *Vitreous Table of the Skull*.

Between the two tables, or *laminae* now described, there is a cellular substance, replete with a medullary fluid, like the spongy substance of other bones: but this is not present in different parts of the skull, and is sometimes altogether wanting in aged persons. Hence, the thickness of the skull is not every where the same; a circumstance peculiarly worthy to be remembered by surgeons, in the operation of trepaning.

In Infants, the *Ossa Parietalia* and the *Ossa Frontis* do not coalesce till the third year; but the interstice, which is obvious enough, is filled up with a strong membrane, called the

seventh or eighth week after conception (Instit. Phys. § 634.).

At birth, the head is nearly one third of the whole body; but it becomes less in proportion as the child becomes older,

Fontanella or *Fons Pulsatilis* ⁽²¹⁾. Moreover, it is to be remembered, that the various bones of infants, soon after birth, are generally composed of many parts, and that these parts gradually unite, in the progress of growth.

The Head, if we respect the moveable articulation of its bones, is connected with the first *vertebra* of the neck, by *Ginglimus*; and with the lower jaw, by *Arthrodia*. All

(21) It is also called *Fontanella Anterior* (Roederer, *Elem. Artis Obst.* § 78.), to distinguish it from the *Fontanella Posterior*, or *Occipital Fontanella* (Nesbitt's Human Osteogeny, page 43.). In a foetus, the place of the bones of the skull being supplied by the *dura mater*, and a membrane which in the adult is called *pericranium*, we are enabled to discover the beginning of ossification between these membranes, and to mark their separation from each other, as effected by the newly formed bone. Such is the manner in which the bones of the skull are formed, and consequently the *fontanellae*. If the bones of the skull were completely ossified before birth, one very great inconvenience must necessarily occur; which is, that the head would not admit of compression, during labour. But Nature has wisely ordained that the bones of the skull shall not be perfectly formed till after birth: and she has been equally provident in causing the quicker ossification of the posterior angles of the *ossa parietalia*, and the superior angle of the *os occipitis*, to obliterate the Occipital *fontanella*, and prevent the inconvenience of pressing the *cerebellum*; which is perhaps attended with more danger than compressing the brain (Morgagni, *Adversaria Anat.* II. *Animad.* 32.). Moreover, the skull is sometimes not perfectly ossified till several years after birth; and the Anterior *Fontanella* often remains in adults, as many anatomists affirm, amongst whom is Kerckringius, who says it is nothing extraordinary, he himself having observed it in ten different people (*Osteogenia Foetuum*, Cap. II.).

the three kinds of immoveable union, or of *immediate symphysis*, of bones, occur in the head: for, of the bones of the face, for example, some of the nose are joined together by Harmony; others, as the teeth, by *Gomphosis*; and those of the skull by Suture.

There are five Sutures: three of which are named *True*, and two *False* or *Spurious*.

The *Coronal Suture* measures the head transversely; and connects the *Os Frontis* with the *Ossa Parietalia*.

The *Sagittal Suture* divides the superior part of the skull into two equal parts, and connects the *Ossa parietalia* together. It begins at the middle of the coronal future, and ends at the middle of the lambdoidal.

The *Lambdoidal Suture* joins the *Os occipitis* to the bones of the crown of the head. Little bones are very frequently found, generally of a triangular figure, in this future, between the *Os occipitis* and the *Ossa sincipitis*. The futures now mentioned, are *True* ones.

The two *False* or *Spurious Sutures*, by which the *Os Temporale* of each side is connected with the *Os Parietale* of the same side, are called *Squammous*.

The Sutures hitherto mentioned only connect the bones of the head to one another; and are, therefore, called *Proper Sutures*, in contradistinction to those which join the bones of the head to the bones of the face, called *Common Sutures*. Of the latter, there are
four;

four; to which particular appellations are assigned, viz. the *Transverse Suture*, by which the *Os Frontis* is connected to the *Os Nasi*; and the *Sutures of the Sphenoidal, Ethmoidal and zygomatic bones*, by the intervention of which, they are connected with the bones next them. There are no particular names given to the other futures, because they are of less concern.

The juncture of the true futures is made by means of bony irregularities and hook-like projections, of greater or less size, which are reciprocally appropriated to, and confined by, others of the corresponding bone.

The use of the futures of the *cranium* is (1.) that the hollow sphere may be better formed: (2.) that, during birth, the magnitude of the head of the *foetus* may be lessened; for, at that time, the bones are not only pressed nearer to one another, but also frequently ascend over one another, so as greatly to facilitate the labour: (3.) that, by including evident spaces, there may be a communication between the *dura mater* and *pericranium*; and consequently, of the internal and external vessels of the skull: (4.) that fractures of the skull may be lessened in their extent; for these futures put limits to fractures⁽²²⁾: (5.) that, by yielding,

(²²) Fractures nevertheless are sometimes found continued through the futures; but whether the violence were at once inflicted on both bones, or whether it affected only one, so that the fracture was continued from it to the

yielding, or receding one from another, they may often defend the brain from external injuries; which, but for that, might be productive of irreparable harm.

Of the Bones of the Skull.

Of the eight bones, which form the skull, the foremost is the *Os Frontis*. Its figure is very much like that of a cockle's shell⁽²³⁾. In adults, it is only one bone: but in infants, it is very evidently composed of two.

The *structure of the os frontis*, as of the other bones of the *cranium*, is composed of two *laminae*, with an intermediate spongy sub-

other, in the cases which I have seen and read, it is hard to say. I am of the former opinion, if the sutures be perfect.

Sometimes there are no sutures: instances of which are cited by Diemerbroeck, from Aristotle, and Vesalius, Fallopius, Coiter, Joannes à Cruce, Alexander Benedictus, &c.

Eustachius has described a double sagittal suture (*Offium Examen.*) The sagittal suture is often extended through the *os frontis* (Note²⁶); and has been seen continued through the *Os Occipitis* as far as the Great Occipital Foramen (Vesalius, *De Fab. H. 6. Lib. I. Cap. V. Fig. 3. 4.* Paaw, *In Cels. De Medic. Cap. I.* Sylvius, *Comment. ad Galen de Offib.*).

M. Thouret says, that the sutures being pressed together, and the brain being diminished and equally compressed, while the child's head passes through the *pelvis*, shows that one use of the sutures is to render the child torpid and insensible (*Hist. de la Société Royale de Médecine, 1779.*).

(²³) *Concha Bivalvis. Linnaei Systema Naturae.*

stance. The ossification of this bone commences over the superciliary arches.

We ought to remark in the *os frontis*, its *external surface*, which is convex and prominent; and its *internal surface*, which is concave; its *superior margin*, its *two lateral margins*, and its *inferior margin*. The three former of which are deeply denticulated; but the inferior margin is broad and unequal. In infants, a large portion of the superior margin is wanting; so that the *fontanella*, as already noticed, is thereby enlarged.

The *External Eminences*, *Depressions* and *Cavities* of the *Os Frontis* are the following: (1.) two eminences on each side of the convex surface, immediately above the margin of the orbit; in which are formed the pituitary sinuses of the *os frontis*; and two other eminences forming the *superciliary arches*. (2.) there are also five *apophyses* belonging to this bone: viz. one called *Nasal*; two *External* and *angular*, which extend to the *Os Jugale*; and two *Internal*, which extend to the *Ossa Lachrymalia*.

The *Depressions* and *Foramina* of the *Os Frontis* are (1.) the *two large depressions* which make the superior part of the orbits⁽²⁴⁾: (2.) the small depression, behind the internal an-

(24) In this part of the *os frontis*, called the *Orbital Process* there is no spongy substance or *diploë*, which is observable between the tables of the skull in most other parts. This seems to depend on the pressure of the anterior lobes of the brain, on one side; and that of the eyes, on the other.

gular *apophyses*, which is the seat of the tendon of the *obliquus superior* muscle of the eye: (3.) the depression, which is deeper than the former, and situated below the external angular apophyses, to receive the Lachrymal Gland: (4.) there is likewise a part of the temporal depression on each side of the *Os Frontis*: (5.) In the internal part of the superciliary arches, there is a notch or *foramen*, which is called the *Foramen orbitarium superius*. A small twig from the first branch of the fifth pair of nerves, and also a small artery passes through this *foramen*. Surgeons therefore should take care how they make incisions in this place, especially in children⁽²⁵⁾: (6.) the *Foramen Orbitarium Internum*, through which a twig from the first branch of the fifth pair of nerves passes, together with a branch of the ophthalmic artery: (7.) lastly, the *Foramen* in the internal angle of the eye.

The *Internal Eminences* and *Cavities* of the *Os Frontis*. There is an acute line in the

(25) The fear is not only lest the nerve should be hurt, but also lest the artery should be divided. For neither can the artery itself contract, nor can the haemorrhagy be stopped by astringents. Compression, for the same reason, would be useless, and caustics, which render the bone carious, would be dangerous. The reason of all which is evident, In many skulls, more especially those of children, there are numerous furrows in the convex surface of the *os frontis*; and there are arteries corresponding to these furrows, and fastened to them; so that they cannot themselves contract, by reason of their attachment; nor can they be constricted by astringents, or made to coalesce by pressure, because they are partly hidden in, and attached to, the furrows.

middle, called the *Frontal Spine*; and above it, a long *Furrow*, which is the seat of the longitudinal sinus ⁽²⁶⁾; and below it, the *Foramen Coecum* or *Clausum*, as it is called ⁽²⁷⁾; and below the *foramen coecum*, there is a notch for the reception of the sieve-like part of the ethmoid bone. There are likewise two De-

(26) Sometimes, instead of this Furrow, there is a ridge to which the superior part of the longitudinal sinus is attached. It has been said, that the ridge is found in thin skulls, in which it serves as a support; and that the furrow is only in thick skulls, where no support is needed. But Monro was of a different opinion; having seen a furrow in very thin skulls, and a ridge in very thick ones. This Anatomist imagined that it depends upon the different times at which the ossification of the *Osse Parietalia* is completed. If the superior edges of these bones meet, before they have ceased to grow, their fibres will extend on wards where least resistance is given; that is, between the hemispheres of the brain. This explanation is certainly probable; and Dr. Monro hath given another reason which makes it still more probable. It is this, that adults, whose frontal bone is divided by the sagittal future, never have a ridge in this place. (*Osteol.* p. 83.)

The sagittal future is said by Riolan to be continued through the *os frontis* to the nasal process oftener in women than in men (*Anat. Sect. II. Cap. XIX.*)! But Vesalius's opinion is diametrically opposite (*Lib. I. Cap. VI.*)!

(27) The Longitudinal Sinus begins at this *foramen*, which sometimes opens into the superior sinuses of the *os ethmoides*, sometimes only through the first table of the skull. Morgagni says, that a small process of the falx of the *dura mater* is lodged in it; together with an artery and sometimes a vein (*Advers. Anatom. VI. Animad. 31.*). Ingrassias had long since noticed, that this hole is sometimes in the superior part of the base of the *crista galli* (*Comment. in Galen De Ossib. Cap. I. Com. VIII.*).

pressions

pressions in which the anterior lobes of the brain rest; and *furrows*, without name; and *Depressions* still smaller than they. If the *os frontis* be cut transversely over the orbital ridges, by means of a saw, we may see the two *Pituitary Sinuses*, formed by the separation of the bony tables of the *os frontis* from each other. These are most commonly parted from each other by the intervention of a bony partition. They open into the nostrils, at the internal angular process, but are not formed in infancy.

The *Os Frontis* is connected with three bones of the *cranium*, and four of the face; (1.) superiorly, it is joined to the *ossa parietalia* by the coronal suture: (2.) inferiorly and internally to the ethmoid bone; from which, the suture connecting it receives its name: (3.) posteriorly, and inferiorly, to the *os sphenoides*, by the sphenoidal suture: (4.) inferiorly, and anteriorly, to the bones of the nose, by the transverse suture: (5.) inferiorly and laterally to the lachrymal bones, by harmony: (6.) to the superior maxillary bone, by the transverse suture: (7.) by its internal angular process, to the zygomatic bone, by the zygomatic suture.

The *Use of the Os Frontis* is, to form the temples, orbits, and frontal (²⁸) and pituitary
sinuses

(²⁸) This part, like the orbital process, has no intermediate *diploë*; but, instead of it, the cavities or sinuses here mentioned. Sometimes, however, there are no such sinuses,

sinuses, even in adults; which Fallopius says is oftener the case, where the *os frontis* is flat, and the sagittal suture is extended down to the nasal process (*Expos. De Offib. Cap. XIII.*). On the contrary, Paaw, Riolan, Highmore, Palfyn, and Albinus, have found them where the sagittal suture was continued through the *os frontis*. And Albinus observes, that the sagittal suture thus continued through the *os frontis*, is likewise continued through the interstice, placed between the two sinuses; so that, properly speaking, there is no partition between them; one sinus being in each part of the *os frontis* (Albinus, *A. A. Lib. I. Cap. XI.*). In a full grown foetus, the eminences above the margin of the orbit are said by Dr. Nesbitt to be more protuberant than at full growth (*Hum. Osteog. p. 47.*); yet, in a foetus, there is not the least appearance of frontal sinuses upon cutting through the *Os Frontis*. Besides, Riolan found them in persons, when the forehead and nose was flat and depressed (*Comment. de Offib.*); so that a flatness of the forehead is not a sufficient sign, by which to declare there are no frontal sinuses. There is commonly a bony partition between the right and left sinuses; but the division is seldom exact, or the figure of the inclosed space determinate. The partition too is often imperfect. Sometimes there is only one sinus, there being no bony *septum*, and that one sinus extended over the whole orbit; and sometimes the sinus is on one side only. Sometimes, instead of the frontal sinuses there are many cells separated by bony *septa* (Marherr, *Praelect. in Herm. Boerb. Instit. Med. § 492.*). Wrisberg has remarked, that the frontal sinuses in a male person extended over the whole orbit; that the plates of the orbital process of the *os frontis* were separated two or three lines; and, that the sinuses entered into the less wings of the *os sphenoideale*, and communicated with the sphenoidal sinuses, by a distinct canal, passing to the inside of the optic foramen. He likewise observed, that the frontal sinuses become the asylum of various kinds of worms (Haller, *Pr. Lin. cum Animad. Wrisbergii in § cccclxi. Edit. Gottin. 1780.*). The opening of these sinuses is by one or two oblique canals leading into the anterior cells of the *os ethmoides*. Thus they communicate with the nostrils, and discharge a mucus, which is secreted by the membrane lining them. These sinuses

sinuses ⁽²⁹⁾ to enlarge the organ of smelling; to contain the anterior lobes of the brain; and to receive the longitudinal sinus of the brain. Lastly, it is connected with other contiguous bones by intermediate futures, more or less conspicuous ⁽³⁰⁾.

The

sinuses not only enlarge the organ of smelling, but render the voice more sonorous and melodious.

⁽²⁹⁾ It may be asked what sinus Leber means? Mr. William Cowper, observed, that—"Besides these (i. e. the Frontal Sinuses) in that part of the *os frontis*, that is contiguous to the *os unguis* in the orbit of the eye, there are divers irregular cells, which also open into one another, and into the *Foramina Narium* and *Antrum Maxillae Superioris*. Backwards, these cells also open into the cavity of the *Cella Sphenoidis*. These cells are not (at least commonly) taken notice of by Anatomists (Drake's *Anthrop. Nova*. Vol. II. p. 310.)." Such are Cowper's words. It were to be wished that Leber had been more explicit; for, whether any thing else be intended than what is described in Cowper's words; or, whether even that be intended, by his *sinus pituitarii*, I am uncertain.

⁽³⁰⁾ The *os frontis*, which in adults is oftener one bone ⁽²⁶⁾ is obviously divided into two at birth. The inferior part of the anterior *fontanella* is formed by the space included between the superior extremities of the two bones; each of which, in receding from its fellow, forms a curve.

The Superciliary Arches and Protuberances, which mark the frontal sinuses in an adult, are now more considerable than at full growth; but there are no frontal sinuses.

The *Foramen Orbitarum Internum*, generally formed of the *os frontis* and *os planum*, which serves for the passage of the nasal twig of the first branch of the fifth pair of nerves, cannot be found at birth.

The bones are not connected by future, except the *os petrosum* and *os occipitis*; but by intermediate membrane ^(21.).

The

The two *Ossa Parietalia* or *Ossa Bregmatis* constitute the superior, and also the two lateral parts of the skull. They are the broadest bones of the head, and are somewhat quadrangular.

Their *Substance* is like that of the other bones of the skull.

Osification is first observable in the middle of these bones. The following circumstances may be noticed concerning them: (1.) as to their *external surface*, it is convex; and their *internal surface* is concave: (2.) of their four margins, the *superior* is the largest, and forms the sagittal future. It is imperfect in infants, and consequently enlarges the *fontanella*: the *anterior margin* forms the coronal future, with the *os frontis*; and the *posterior* the lambdoidal future, with the *os occipitis*. The *inferior margin* is contiguous to the *ossa temporalia*. The three former margins are denticulated; but the last adheres to the temporal bone, by the squamous future: (3.) *Four angles*; two *anterior*, of which one is superior, another inferior, but the longest of the four, and distin-

The Osification of the *os frontis* begins, as Leber observes, over the middle of the superciliary arches (Nesbitt's Hum. Ost. p. 49.); and does not come from the circumference to the center, as Kirckringius asserted (*Ost. Foet. Cap. II.*).

The *os frontis* begins to be formed between two and three months after conception; and the two disunited parts seem to continue the same, from the fifth to the ninth month; except that the space between them is gradually lessened (Nesbitt's Hum. Ost. p. 50.)

guishes

guishes the right bone from the left; and *two posterior*.

Moreover, it should be noticed, that there is a *Semicircular Arch* on the external surface of these bones, marked by the adhesion of the Temporal Muscle.

Of the *Foramina of the Offa Parietalia*, there is commonly one on each side, destined for the passage of blood-vessels to the longitudinal sinus (³¹). On the internal surface of these bones, there are many irregular furrows, in which vessels are attached: but the chief of these furrows are they in the anterior and posterior angle, and that which receives the longitudinal sinus of the *dura mater* (³²).

The *Offa Parietalia* are joined (1.) to each other, at their superior margins, forming

(³¹) Sometimes this *foramen* is in one of the *Offa Parietalia* only; and sometimes it is in neither. When it is present it often leads no farther than the diploë; but oftener through both tables of the skull. It commonly serves only for the passage of a vein from the integuments of the head to the longitudinal sinus: but Monro sometimes saw a branch of the temporal artery going through it to the superior part of the falx, and the sides of the *dura mater*; where it had free communication with the branches of the external carotid artery (Ost. p. 91.). If in cutting near these *foramina*, the vessels be divided, they shrink within the skull, and a dangerous hæmorrhage sometimes follows.

(³²) Albinus has spoken elegantly of the formation of these furrows (*An. Acad. L. IV. C. I.*): he differs from Palsin (*Anat. du Corps Hum. Trait VI. Cap. 4.*) and Haller (*Prael. in Boerb. § 304. e.*). Indeed, Albinus puts the matter beyond all doubt, by asking—“*Nonne enim formantur osse circum arterias sensim crescente?*” Cowper says, he saw canals beginning near the *os occipitis* (*Anat. Exp. XC. Tab. Fig. 2.*).

the

the sagittal suture: (2.) to the *os frontis*, at their anterior margins, forming the coronal suture: (3.) to the *os occipitis*, at their posterior margins, forming the lambdoidal suture: and (4.) to the *Ossa Temporum*, and *Sphenoidale*, at their inferior margins, forming the squamous suture.

Their *Use* consists in being an arched roof, for the defence of the middle lobes of the brain, and an attachment for the longitudinal sinus ⁽³³⁾.

The *Os Occipitis* takes its name from its position. It constitutes the hindmost, and is in part the inferior portion of the skull. It is a large, flat bone, and resembles an oblong, irregular arched quadrangle. In adults, it is an entire bone; but in *foetus*, and in delicate children, it is composed of four special parts; in the middle of all which, *Ossification* is first observable.

The *Os Occipitis* is divided, into its *external surface*, which is convex and flat; and its *internal surface*, which is concave; into *four margins*, viz. two superior, denticulated, and two inferior, unequal; to which belong

(33) The figure of these bones in foetus is different from that in adults. The superior and anterior extremities of both receding from each other, to form the posterior and superior part of the anterior *fontanella*. Internally there are no furrows in consequence of the arteries of the *dura mater*. These bones begin to be formed between two and three months after conception; and in six months they have the shape of full grown foetal bones (Nesbitt's H. O. p. 51.).

as many *angles*; one angle, which is the superior, is almost spherical; the two lateral angles; and the inferior angle, which is distinguished by the peculiar name of *Sphenoidal Apophysis*.

On the external surface of this bone, there are the following *eminences*: (1.) in its middle, the *Tuberosity*, as it is called; to which the cervical ligament is joined, and from which an acute line proceeds, named the *Occipital Spine*: (2.) There is an arch extended transversely above the occipital spine, to which many muscles are fixed. (3.) The two *Articular Condyles*, on each side, near the great occipital *foramen*, which are received by the superficial articular depressions of the first *vertebra* of the neck, forming a joint. (4.) The *Sphenoidal Process*.

The *Depressions and Cavities* of the *os occipitis* are (1.) six external on the sides of the occipital spine; *two uppermost, two lowermost, and two middle* ones: (2.) two small depressions before the articular condyles, and many smaller in the cuneiform process. *Four Notches, two large and two small*, at the margin of the sphenoidal process; which, together with the notches of the petrous part of the temporal bone, form the posterior *Foramina Lacera*.

It has *five Foramina*: (1.) The *Foramen Magnum Occipitale*, through which the *medulla oblongata* passes, and the accessory nerve of Willis, and the vertebral artery: (2.) The

four

four *foramina* of the articular condyles; two anterior, for the passage of the ninth pair of nerves, and two posterior, for the passage of the jugular veins ⁽³⁴⁾.

The *Internal Eminences* and *Cavities* are (1.) two eminences, like a cross, called for this reason, the *Internal Crucial Spine* of the *os occipitis*. The superior part of this crucial spine is excavated in the middle or laterally, that it may receive the superior longitudinal sinus. The two lateral parts are likewise excavated, and receive the two lateral sinuses. The inferior part, or *Internal Occipital Spine*, serves for the attachment of the small occipital *septum*.

Four *Depressions* are made by the crucial spine, viz. two *superior*, which receive the posterior lobes of the brain, and two *inferior*, destined to contain the *cerebellum*.

The Sphenoidal Process has a *Long Excavation* in it, where the *medulla oblongata* lies.

The *Substance* of the *os occipitis* is composed of two *laminae*; between which, the spongy substance is in greater or less quantity in some parts than in others. The *os occipitis* is thickest at its superior and middle part, and thinner at its inferior part.

It is *connected with four bones*: (1.) superiorly, with the *ossa parietalia*, by the lamb-

(34) One of these *foramina*, and sometimes both, are wanting. In the latter instance, the jugular veins pass through the *foramen magnum occipitale*, to go to the lateral sinuses.

doidal future: (2.) laterally, with the *osssa temporum*, by the lambdoidal future also ⁽³⁵⁾: (3.) inferiorly and anteriorly, with the sphenoidal bone, by the sphenoidal apophysis: (4.) inferiorly, with the first *vertebra* of the neck, by *ginglimus*.

The *Use of the os occipitis* is, to contain the *cerebellum* and posterior lobes of the brain; to afford a passage for the *medulla oblongata*, and various nerves and vessels going in and out of the skull. Lastly, it serves in moving and keeping the head steady ⁽³⁶⁾.

The

(35) The *Os Occipitis* is more commonly said to be connected laterally with the *osssa temporum*, by the *Additamentum Suturae Lambdoidalis*.

(36) The *Os Occipitis* consists of four bones, at birth; connected together by cartilage. The first and largest, constituting the posterior part of the *os occipitis*, and situated above the great *foramen*, is in figure like a spherical triangle. Its figure, in *fœtuses* of the same age, varies more than that of any other bone of the head. It is often divided from its superior angle as far down as its middle; sometimes there is a notch here, and sometimes it is without either notch or division. The protuberance, or tuberosity as it is called, is larger in proportion to the rest of the bone than in adults. It is more concave internally than in adults. Small bones called *Ossa Triquetra* (See Note 54.) are frequently found at the uppermost angle of this bone, at birth; which is a proof, as Dr. Nesbitt remarks, that these little bones are natural, and not the consequence of fractures (Hum. Ost. p. 53.).

The condyloid processes which belong to the second and third portions of this bone, are not so large in proportion to the whole, as in adults.

The Fourth part, commonly called the cuneiform process, differs from that of adults, in having a less hollow interiorly for the *medulla oblongata*.

All

The *Ossa Temporum* are two bones occupying the lateral parts of the head, constituting the *Temples*, as they are called, and concurring to form the basis of the skull. The *figure* of each bone is irregular. In adults, each bone is entire; but in young children, the squamous part is separated from the petrous. The point of ossification is first discernible under the beginning of the zygomatic apophysis of the squamous part. The petrous part in a foetus seven months old, is altogether composed of a softer substance (37).

Each of these bones in an adult is divided into two parts, viz. one which is semicircular, and is called *Squamous*; and another which is pyramidal, and called *Petrous*.

All these bones, as they are called, are connected to one another by cartilage; and to the *ossa parietalia* by membrane. The petrous connection is by cartilage and membrane.

The ossification of these bones is never completed till after birth.

(37) At birth, each temporal bone is generally said to consist of three distinct parts, independent of the bones of the ear; viz. the superior or squamous part, the inferior or petrous part, and the *circulus* or *annulus* which surrounds the orifice of the *tympanum*. The last part is only mentioned in the *Osteogeny*, where the threefold division is used. This *annulus*, though perfectly formed three months after conception, is as small as a hair; and becomes gradually elastic, till encreasing in growth, its elasticity diminishes, and is at length imperceptible. It is not a perfect ring, as one would imagine from its name, for its two extremities do not meet, but are attached to the squamous part of the temporal bone.

We may consider in the squamous part,
The *External surface*, which is convex,
and the *internal surface*, which is irregularly
concave :

The *Two Semicircular Edges* ; of which,
the one is contiguous to the zygomatic bone,
and the other to the parietal and sphenoidal
bone ⁽³⁸⁾ :

In the petrous part are observed ⁽³⁹⁾,

Three surfaces ; an *external inferior*, an *in-*
ternal superior, and an *internal posterior*
surface :

As many *Angles* as surfaces ; by which
the surfaces are divided :

The *Apex* ; which joins the cuneiform
bone :

The *Basis* ; which is connected to the *os*
occipitis :

The following *Apophyses* or *Processes*, are
on the external surface of each temporal bone.

The *Mastoid Process*, situated inferiorly and
posteriorly, and composed internally of many
small cells, which are lined with a mucous
membrane ⁽⁴⁰⁾ :

⁽³⁸⁾ This edge does not lap over the parietal bone at
birth.

⁽³⁹⁾ So called from its hardness ; for which reason, it
has also been called *Os Lapidosum*. At birth it is harder
than the other bones ; and in adults it is so hard as to be
exceeded only by the enamel of the teeth.

⁽⁴⁰⁾ This process is not formed at birth, nor is its
place supplied by cartilage. It is not solid in adults,
but has numerous small cells internally, which open into
the cavity of the *tympanum*.

The

The *Styloid Process* arising from the petrous part ⁽⁴¹⁾:

The *Zygomatic Process*, which begins at the squamous part, is thicker at its origin, and sends an *oblique eminence* to the articulation, intended to strengthen the interarticular meniscoid cartilage. As it descends, it becomes smaller; and is at last connected with the temporal process of the zygomatic bone, to form with it the *Zygomatic Arch* ⁽⁴²⁾.

The *External Cavities* of the temporal bone are,

The *Articular Cavity* of its inferior surface ⁽⁴³⁾:

The

⁽⁴¹⁾ This is always cartilaginous at birth, and is often not perfectly ossified even in adults. Sometimes it consists of many parts. This process is always close to the skull in foetus, and is extended across the *Meatus Auditorius externus* till some months after birth.

⁽⁴²⁾ Perhaps it would be better to say, that the zygomatic process which arises from the inferior part of the squamous portion of the temporal bone, is connected with the zygomatic apophysis of the zygomatic bone: for, the zygomatic arch is formed by this connection, as Leber himself notices in describing the zygomatic bone; but he makes no mention of the temporal process of the zygomatic bone, there being no such process; this, therefore, seems to be a mistake in the original, unnoticed in the *errata* of the Latin edition. It is enough for me to mention it in a note.

⁽⁴³⁾ This oblong cavity corresponds with the condyle of the inferior *maxilla*. A transverse section of both the articular cavity and oblique eminence of the zygomatic process of the temporal bone, represents the italic letter S. They both serve for the articulation of the condyloid process of the lower jaw; and are covered with a car-

The *Fissure* in the middle of the *Articular Cavity*:

The *Orifice* of the *Meatus Auditorius Externus*, on the external surface of the squamous part :

The *Furrow* under the mastoid apophysis :

The *Stylo-mastoid Foramen*, situated between the mastoid and styloid apophyses ; and destined for the transmission of the *portio dura* of the auditory nerve ⁽⁴⁴⁾ :

The *Notch* of the petrous part, which together with a similar one of the *os occipitis*, forms the *Foramen Lacerum*, out of which the external jugular vein goes :

The *Carotic Canal*, by which the internal carotid artery enters, and the great intercostal nerve goes out :

The Bony Part of the *Meatus Auditorius Externus*, near the canal above mentioned, which runs between the squamous and petrous parts to the *tympanum*.

Internally, we may notice in each of the temporal bones,

Small Denticulations, of which the squamous future is formed :

The *Depression*, in which the middle lobe of the brain rests : Also various furrows

gelatinous substance, which Mr. Hunter says is somewhat ligamentous (*Nat. Hist. of the Hum. Teeth*, p. 9.) ; for by putrefaction it peels off, like a membrane, with the common *periosteum*.

(44) This *foramen*, or *Aquæductus Fallopii*, is larger in *fœtus* than in adults.

running

running without any determinate order or number, but serving for the attachment of vessels:

The *Furrow* of the superior angle, for the middle sinus of the *dura mater*:

The *Meatus Auditorius Internus*, on the posterior surface of the petrous apophysis, which is the passage of the *portio mollis* of the auditory nerve ⁽⁴⁵⁾:

The *Internal Orifice of the Aqueduct of Fallopius*, which ends in the *foramen* already noticed, between the mastoid and styloid processes; receiving the *portio dura* of the auditory nerve:

The *furrow* in the basis of the petrous apophysis, for the lateral sinus of the *dura mater*, and the *depression* for the occipital vein:

In the posterior angle of the petrous apophysis, near its middle, the *Foramen Lacerum*:

In the petrous portion of the temporal bone the *Organ of Hearing*; concerning which, the following may betaken into consideration:

1. The *Meatus Auditorius Externus*;
2. The *Cavity of the Tympanum*;
3. The *Labyrinth*, and
4. The *Meatus Auditorius Internus* ⁽⁴⁶⁾.

The

(45) This, like the *Stylo-mastoid foramen*, is larger in *fœtus* than in adults.

(46) It were needless to speak of the bones of the ear at present, because the consideration of them is so inseparably

The *Meatus Anditorius Externus*, is a crooked canal, six lines or more in length, and wholly bony in adults. The external orifice of this passage, which begins at the *concha*, is situated superiorly in the squamous, but inferiorly in the petrous portion of the temporal bone: from thence this canal is turned obliquely inwards, and is narrower in the middle than at either ex-

separably connected with that of the other parts, that a mere reference, when treating of the sense of hearing, would not be sufficient to satisfy the curiosity of an inquisitive person, much less to supplant the necessity of centering the whole anatomy of so exquisite an organ into one point of view. This seems to accord with the intention of Leber, whom I conceive to have been of the same mind, from the accurate description of the bones of the ear, given near the end of these prelections. I shall, therefore, content myself by remarking that some anatomists, amongst whom was Heister (*Compend. Anatomic.* § 68.), have considered the *Officulum Orbiculare* not as a distinct bone, but only an epiphysis of the longer *crus* of the *incus*. That it is, however, a peculiar bone, consequently that there are four bones of the ear, seems to me demonstrably evident, for two reasons: the one is, that when we attempt to separate the bones of the ear from one another, the *Officulum Orbiculare* remains attached to the *stapes* as often as it does to the *incus*, which could never happen if it were an epiphysis of the *incus*. The other reason is deduced from the doctrine of epiphyses, and proved from the irrefragable observation of writers on osteogeny, who have noticed the formation and increase of the several parts, and their changes even to the time of birth. From such observation it is certain, that the *Os Orbiculare* of a foetus only six months old, is completely bone: so that there is no difference between it in a foetus and in an adult, except that, like the other bones of the ear, its solidity is greater in the latter.

tremity.

tremity. The internal orifice is surrounded by a groove, in which the *membrana tympani* is contained. Immediately after birth, the *meatus auditorius* is soft, and a bony circle or ring is only found, to which the *membrana tympani* is attached.

The *Tympanum*, or *Cavity of the Tympanum*, is oblong, but in figure indeterminate. It receives the *Meatus Auditorius Externus*. It is divided into an *anterior*, a *posterior*, and a middle region, in each of which there are various inequalities.

The Cavities and *Foramina* are

The *Orifice of the Auditory Tube*; which is an oblong, conoid passage, partly cartilaginous and partly membranous. Its cartilaginous part opens into the ear, but its membranous part, into the cavity of the *fauces*, behind the nostrils.

The *Canal*, in which the *tensor tympani* muscle is fixed. It arises from the orifice of the tube, and is terminated at the *fenestra ovalis* in a small hook.

An *Aperture*, leading to the cellular substance of the mastoid process.

The *Fenestra Ovalis* is an oblong or elliptical *foramen*, opening into the *vestibulum*, and shut by the *stapes*.

The *Fenestra Rotunda* is a *foramen* less than the former, but wholly round, leading to the *coclea*, and closed by a particular membrane.

The four following little bones are contained in the cavity of the *tympanum*:

I. The

1. The *Malleus* :
2. The *Incus* :
3. The *Ossiculum rotundum*, or *orbiculare* :
4. The *Stapes*.

Of the *Malleus* we may observe

Its *Round Head*, which is encrusted with a thin cartilage, and annexed to the *Incus* by *ginglymus*.

Its *Narrow Neck*, situated between the head and *manubrium* or handle ; from which a long slender process arises, adheres to a furrow in the auditory tube, and is continued as far as the fissure in the articular cavity of the temporal bone.

Its *Manubrium*, terminated by an enlarged extremity, and connected to the *membrana tympani* by a short, conoid process.

The situation of the *malleus* in the cavity of the *tympanum* is as follows. Its head and neck are situated upwards and joined to the *incus* : its *manubrium* descends in the direction of the *membrana tympani*, to the middle of which it is attached by means of its large extremities, which are inflected somewhat outwards ; it is also joined to the greater *crus* of the *incus* by a small ligament.

The *Incus* is the largest and strongest bone of the ear. It is divided into its body and two *crura*.

Its *Body* is situated anteriorly, is rather broad than thick, and has two eminences and two depressions, both covered with cartilage,

tilage, and intended for the reception of the head of the *malleus*.

Its *Shorter Crus* extends no farther than the cells of the mastoid apophysis.

Its *Longer Crus*, together with the *manubrium* of the *malleus*, to which it is connected by a ligament, is of the same extent as the shorter; but its extremity being curved inwards, it receives the *ossiculum orbiculare*, by the intervention of which it is united with the *stapes*.

The *Ossiculum Orbiculare* is the least bone in the human body. It is situated between the long *crus* of the *incus* and the head of the *stapes*, and connected with both the bones now mentioned by its two convex surfaces.

The *Stapes* is so named from the similitude which it bears to a horseman's stirrup. The parts of it to be remembered are,

Its *Head*, which is formed by the union of its two *crura*. It receives the *ossiculum orbiculare* in its excavated extremity, and is connected by this with the longer *crus* of the *incus*.

Its *Two Crura*, each of which is bent into an arch, as in a horseman's stirrup.

Its *Base*, which covers the *fenestra ovalis*.

The *Labyrinth* is that part of the ear, situated behind the cavity of the *tympanum*, which opens into the two *fenestrae* already described.

We ought to notice in the Labyrinth,

1. The *Vestibulum* :

2. The

2. The *Three Semi-circular Canals*:3. The *Cochlea*.

The *Vestibulum* is a cavity unequally round, situated between the *cochlea* and semi-circular canals. Its more remarkable apertures are the following: viz.

1. The *Five apertures of the Semi-circular Canals*:2. The *Fenestra Ovalis*:3. The *Scala Vestibuli*.

The *Three Semi-circular Canals* are situated at the base of the petrous apophysis, and, in adults, are firmly fastened to it. They somewhat exceed half the circumference of a circle, and are of less diameter in the middle than at either extremity. They are distinguished from their situation into 1. *Inferior and Posterior*; 2. *Superior and Middlemost*; 3. and *Exterior and Foremost*.

The situation of the two former is perpendicular, but of the third horizontal. Each of these canals has two apertures, though they all open into the *vestibulum* by five orifices: because one opening of the superior canal is conjoined with another of the inferior, both forming a common outlet.

The *Cochlea* has obtained its name from its figure. It is stationed anteriorly towards the apex of the petrous apophysis.

In the *cochlea* are comprehended

1. The *Bony Nucleus* or *Modiolus Cochleae*, which is of a conoid figure, perforated with many

many small holes, throughout its whole length, and terminated in an apex.

2. The *Spiral Windings* of the cavity about the *modiolus*, like those of a snail's shell. Of these windings, there are only two and a half; which are divided in the middle by a partition, into two equal parts, called *Scalae*. These arise from the middle of the *modiolus*, and end in two openings; the one leading into the *vestibulum*, the other into the *fenestra rotunda* of the *tympanum*: hence this is called *Scala tympani*, and that *Scala vestibuli*. The cavities of these *scalae* communicate with each other, by means of a small *foramen* in the middle of the *modiolus*.

3. The *Spiral Lamina*, which was formerly called the Diaphragm, divides the *cochlea* into two equal parts. It is mostly bone, but its exterior part is somewhat membranous. It is wholly covered with a medullary coat.

The *Meatus Auditorius Internus* is a small bony passage, beginning internally by a longitudinal orifice at the posterior surface of the petrous bone, running towards the *vestibulum* and *cochlea*, and there being divided into two less cavities by means of an eminence. The superior and smaller of which is the orifice of the Aqueduct of Fallopius, which receives the *portio dura* of the auditory nerve: the other inferior and larger cavity is perforated by very many small holes, through which the *portio mollis* of the auditory nerve passes into the labyrinth.

The *Aqueduct of Fallopius* passes outwards through the superior surface of the petrous apophysis, and communicates with the cavity of the *tympanum* by means of a small *foramen*, situated between the anterior semi-circular canal and the *fenestra ovalis*. It descends in the posterior part of the cavity of the *tympanum*, and opens in a *foramen*, between the styloid and mastoid apophyses.

Every part of the ear yet mentioned is covered with a very thin *periosteum*.

The *Substance of the squamous part of the ossa temporum* is composed of two bony *laminae* and an intermediate *medulla*. The *Mastoid Apophysis* consists of cells, the *Petrous Apophysis* is a firm and compact substance.

The *Ossa Temporum* are connected with five bones of the skull: viz.

1. Superiorly, with the *ossa parietalia*, by the squamous suture.
2. Posteriorly and inferiorly, with the *os occipitis*, by the lambdoid suture.
3. Anteriorly and Inferiorly, with the *os sphenoidale*, by harmony.

The *Ossa Temporum* are likewise joined to two bones of the face: viz.

4. Anteriorly, with the *os jugale*, by harmony.
5. With the lower jaw, by *arthrodia*.

The *use* of these bones is, to seclude and defend the organs of hearing; to contain the middle lobes of the brain, and a part of the

cerebellum; to form the temples; and to constitute a part of the base of the skull.

The Os Sphenoidale.

Os Sphenoidaleum, or *Basillare*, or *Cuneiforme*, or *Multiforme*, is seated inferiorly at the base of the skull; and is infixed between the bones of the skull and those of the face, like a wedge.

The *Figure* of this bone is like that of a Wasp, or a Bat, with its wings expanded.

In a *Fœtus* it consists of five parts; and in children, not long after birth, its two lateral parts may be separated from its body.

The spongy substance of this bone is covered with thin bony *lamellae*, which grow very hard by age; but the lateral parts have little *medulla* interposed between their *laminae*.

It is divided into its *Body* and *Processes*;—into its *Internal Surface* turned towards the cavity of the skull, and its *External Surface* towards the neck.

The *Eminences*, or *External Apophyses*, are these, viz.

1. The *Inferior Sphenoidal Spine* situated in the middle of the body of this bone, receiving the *os Vomeris*: from which a small eminence arises at the union of this and the ethmoid bone.

2. The *Two Temporal Processes*, or *Great Wings*, extended as far as the *ossa temporum*, and *sincipitis*.

3. The

3. The *Two Orbital Processes*, connected with the *os frontis*, and *os jugale*, and concurring to form the orbits.

4. The *Two Pterygoid Processes*, each of which is divided into two *Small Wings*, one *External*, another *Internal*. The superior part of these processes is called the *End*, the inferior part is called the *Root*.

5. The *Hook* at the end of the posterior wing, around which the posterior muscle of the palate passes.

6. The *Two Spinous Processes*, situated posteriorly and superiorly, having a groove laterally, to which the cartilaginous part of the auditory tube is attached.

The *Internal Eminences* are these, viz.

1. The *Two Small Wings*, which are very thin, and concur to form the superior orbital fissure.

2. The *Four Ephippial Processes*; two *Anterior*, and two *Posterior* ⁽⁴⁷⁾.

The *External Sinosities and Cavities* are,

1. The *Sphenoidal Pituitary Sinuses*, which are two cavities in the body of this bone, under the *Ephippium*. The size of these cavities is various. They are commonly divided by a bony *septum*, and open into the cavity of the nostrils, at the sides of the sphenoidal spine ⁽⁴⁸⁾.

2. The

⁽⁴⁷⁾ These are more commonly called *Anterior* and *Posterior Clinoid Processes*.

⁽⁴⁸⁾ These sinuses, which are less than those of the *os frontis*, are like them subject to great variety. When there

2. The *Pterygoid Cavities*, 'between the pterygoid processes of each side, for the insertion of certain muscles.

3. The *Two Pterygoid Foramina*, at the root of the pterygoid processes. They are the orifices of two canals distinguished by the same name, through which the recurrent branch of the fifth pair of nerves passes.

4. The *Two Spinous Foramina*, at the apex of the sphenoidal spine, which give passage to the middle artery of the *dura mater*.

5. The *Two Spheno-palatine foramina*, through which nerves and blood-vessels pass to the pituitary membrane.

The *Internal Foramina and Cavities* are

1. The *Two Sphenoidal or Superior Orbital Depressions*, in the external margin of which there is a small groove, or, as sometimes hap-

there are two sinuses, they are often of unequal extent; but sometimes there is only a single sinus and duct leading into one nostril (Monro's Ost.). Sometimes there are four sinuses separated one from another, by three bony partitions (Sabatier, *De l'Osteologie*). Sometimes there are no sinuses, but in their stead a number of cells (Vesalius, *De Fab. C. H.*). We are told by Albinus (*De Ossibus*, § 39.) that these sinuses have not unfrequently extended as far backwards as the *foramen magnum* of the *os occipitis*.

In a foetus there is no trace of sinuses (Marherr in *Pr. Boerb.* § 492.): and even at birth, there is only the beginning of sinuses (Nesbit Hum. Ost.); their place being supplied by cartilage.

These sinuses, intended, perhaps to enlarge the organ of smelling, are invested with a membrane, like that of the frontal sinuses.

pens, a *foramen* for the passage of a branch of the external carotid artery into the skull.

2. The *Optic Foramina*, through which the optic nerves pass, together with the central arteries.

3. The *Depression* between the four processes of the *ephippium*, or *sella turcica*. It is the seat of the pituitary gland. There are likewise various small *foramina* in this place, which lead to the pituitary sinuses of the sphenoidal bone. At the posterior ephippial processes, on both sides, there is a groove for the internal carotid artery.

4. The *Two Round Foramina*, for the passage of the superior maxillary nerve: and

5. The *Two Oval Foramina*, for the passage of the inferior maxillary nerve.

The *Os Sphenoideum* is connected with all the seven bones of the skull: with three pair, and a single bone of the face: anteriorly,

1. with the *os frontis*; 2. *os ethmoideum*, 3. *ossa maxillaria*, 4. *ossa zygomatica*: laterally, 5. with the *ossa temporum*, 6. *ossa syncipitis*: posteriorly, 7. with the *os occipitis*: inferiorly, 8. with the *ossa palatina*, and 9. *os vomeris*.

Its *Use* is to contribute in forming the orbits, the temporal depressions, and the base of the skull. It assists likewise the evacuation of the mucus of the nostrils, and affords a passage for most of the nerves of the brain.

The Os Ethmoideum.

The *Os Ethmoideum*, or *Cribriform* has no fellow. Its name is derived from the very numerous holes, with which it is pierced, so as to resemble a sieve. It is situated in the interior and forepart of the base of the skull, between the *os sphenoidale*, the root of the nose, and the orbital cavities. The superior part of this bone fills up the whole notch of the *os frontis*.

Its *Figure* is very irregular.

In a *foetus*, it consists of three parts ; which are again composed of very thin *lamellae*, inclined one towards another. In adults, these parts coalesce into one bone.

The Ethmoid bone has *six surfaces*, viz.

1. The *Superior Surface*, which faces the cavity of the skull, resembles a horizontal plate, and is perforated with very many holes, like a sieve ; through which the first pair of the nerves of the brain passes to the nostrils ⁽⁴⁹⁾.

2. The *Inferior Surface*, which is turned towards the nostrils, is formed like a honey-comb.

3. The *Anterior Surface*, which is contiguous to the *os frontis* and its pituitary sinuses.

4. The *Posterior Surface*, connected with the *os frontis* by a small notch.

(49) At birth it is cartilaginous (Nesbitt's Hum. Ost.).

5. The *Two Lateral Surfaces*, which are thin and smooth, constituting the chief part of this bone, and an internal part of the orbits ⁽⁵⁰⁾.

The *Eminences* of this bone are,

1. The *Crista Galli*, which is extended from the middle of the superior surface, dividing the bone into two parts. The falciform process of the *dura mater* is fastened to the *crista galli* ⁽⁵¹⁾.

2. The *Perpendicular Lamina*, or *Ethmoid Septum*, is continued from the *crista galli*, perpendicularly through the middle of the ethmoid bone. It divides this bone into two equal parts, and is connected with the *os vomer*, where it projects on the inferior surface.

The *Substance* of the ethmoid bone, both superiorly and laterally, consists of thin bony *lamellae*. Inferiorly and internally it consists of the *Superior Spongy Bones*, ⁽⁵²⁾, as they are called: of which the convex part is opposite the

⁽⁵⁰⁾ This part is commonly called *Os Planum*. At birth, it is almost entirely surrounded by a cartilage, which lies under a part of the orbital process of the *superior maxilla* and *os unguis*. (Nesbitt.).

⁽⁵¹⁾ The *Crista Galli*, and *Nasal Lamina*, are both cartilaginous at birth (Nesbitt's *Hum. Ost.*). Fernellius called the *Crista Galli*, *Verruca Praedura*; Sneider called it *Septum Ossis Spongiosi* (Diemerbroeck, *Anat. C. H. Lib. IX.*).

⁽⁵²⁾ These are also called *Ossa Turbinata Superiora*. They are generally ossified at birth, where they join each other: but posteriorly as they decrease in breadth, they become

the nostrils, and the concave part is turned laterally towards the superior maxilla. These *Ossa Spongiosa* are separated from each other in the middle, by a double perpendicular lamina: but they are surrounded on all sides by a pituitary membrane.

The *Cavities* and *Foramina* of the *Ethmoid Bone* are these, viz.

1. The *Ethmoid Foramina*, which are on the superior surface, serving for the passage of the olfactory nerves (⁵³).

2. The

become more cartilaginous. Many have considered them as distinct, peculiar bones: but there is a manifest impropriety in doing it, since in adults they are firmly connected with the ethmoid bone. Morgagni has described two other *ossa turbinata* less than the former (*Advers. Anat.* VI. Tab. II. Fig. 3. q q.): and Cowper says, there are commonly found two *Ossa Spongiosa*, placed one above another, and sometimes three, in each nostril. That which is continued from the ethmoid bone is irregular, and seldom seen. The two others are always present naturally. The middlemost is largest, and is attached to the nasal process of the superior maxilla, next the cavity of the nostril of the same side.

(53) Professor Scarpa, in his description of the *os ethmoideum*, takes notice of *External* and *Internal Foramina* of the horizontal or cribriform plate; which, he says, are separated from each other by a (*Rima*) fissure, opening between the upper and foremost part of the cavity of the nostrils. He also makes a threefold division of the (*canaliculi*) little canals of the ethmoid bone; the first and shortest of which, are few in number, extended only the depth of the horizontal lamella, and opening between the beginning of the bony septum of the nose, and the root of the superior spongy bones. The second class of these little canals are more numerous than the first, and penetrate deeper; they descend through the internal *foramina*

2. The *Orbital Foramen of the Nose*, which is in the interior surface of this bone, and is the passage of the ophthalmic nerve.

The *Os Ethmoides* is connected with seven bones: that is, with two of the skull and five of the face. 1. With the *os frontis*, 2. *os cuneiforme*, 3. *ossa maxillaria superiora*, 4. *ossa lachrymalia*, 5. *ossa nasalia*, 6. *ossa palatina*, 7. and *os vomer*.

The *Use of the Ethmoid Bone* is, to support the anterior lobes of the brain, to afford an exit to the first pair of nerves, to serve as a place of attachment for the falciform process of the *dura mater*, and lastly to concur in forming the organ of smelling.

The Officula Triquetra (54.).

If these bones be present, they are of various *mina* to the *septum*. The canals of the third series come from the external *foramina*, having the root and origin of the superior spongy bones under them.

None of these canals extend as far as the inferior spongy bones.

There are two other semicanals leading obliquely forwards from the posterior apex of the middle spongy bone, which must be distinguished from the little canals or tubes of the cribriform *lamella*; for they neither originate at that *lamella*, nor do they receive the first, but the fifth pair of nerves (*Anatomicur. Annotation. Lib. II. De Organo Olfactus, &c. pag. 6. &c.*).

(54) These are frequently called *Ossa Wormiana*; as if found out by Olaus Wormius. Nevertheless Heister asserts that they were known to Galen (*Comp. Anat. § 75.*). They are likewise improperly called *Triangularia* and *Triquetra*: yet their figure is often oblong.

rious

rious size ⁽⁵⁵⁾. Some are small and narrow; others are large and broad ⁽⁵⁶⁾. Besides, their number is uncertain ⁽⁵⁷⁾.

They are oftener found between the bones of the sinciput and the occipital bone, in the lambdoidal future, than in the coronal and sagittal futures ⁽⁵⁸⁾. They are very seldom found in the futures, which intercept the bones of the face, and those of the skull. The margin of these bones is entirely denticulated,

⁽⁵⁵⁾ Diemerbroeck says, the greatest is not larger than the thumb-nail (*Anat. C. H. Lib. IX.*).

⁽⁵⁶⁾ Bartholine (*Anat. Refor.*) and Diemerbroeck both assert, that they are larger and more conspicuous in the concavity of the skull (*Ibid.*). But Monro asserts the contrary (*Ost. p. 70.*), and so does Sabatier.

⁽⁵⁷⁾ There is seldom more than four or five in one skull. Heister tells us that he kept a skull in his museum, in which, the lambdoid future being two fingers breadth broad, contained more than twenty distinct bones of this kind (*Comp. Anat. Nota d. in § 75.*).

⁽⁵⁸⁾ Sabatier says they are often found in the sagittal future, and sometimes in the coronal, sphenoid, and other futures (*De l'Ost.*). Dr. Nesbit has given a plate in which there are the beginnings of three, between the superior margin of the greater wing of the sphenoid bone, and the *os frontis* and *os parietale* (*Hum. Ost. p. 18.*). Sabatier cautions Surgeons lest, in searching for injuries of the skull, they mistake the futures of these particular bones for fractures.

As to the origin of the *Ossa Triquetra*, Monro's opinion is, that the bones betwixt which they are found, become so solid before their bony fibres meet, as not to be capable of further extension; so that the middle space which remains unossified, begins to ossify at several distinct points; which extend and enlarge so as to be indented in the margins of the larger bones (*Ost. p. 71.*).

culated, making a true suture with the contiguous bones.

THE SECOND ORDER.

The Bones of the Face.

THE Face is the anterior, inferior, and less part of the head; somewhat like a triangle, and divided into the *Upper* and *Under Jaw*.

To the upper jaw are referred thirteen bones; all of which, one excepted, are pairs.

The under jaw consists only of one bone.

The Ossa Maxillaria Superiora.

These are the largest bones of the upper jaw; placed anteriorly in the middle of the face, and connected with each other.

As to the *Figure* of each, whether it be regarded individually or conjunctly, it is always irregular.

We may observe in them

The *External Surface*, which may be seen externally in the face and palate:

The *Internal Surface*, making the greater part of the cavity of the nose:

Their number is greater in children than in adults. They are discernible even in the skulls of foetus; and consequently cannot be the effect of fractures.

Both

Both bones have many *Eminences* and *Concavities*.

The *Eminences*, *external* and *internal* are these, viz.

1. The *Nasal Processes*, which reach as far as the *os frontis*, and constitute the lateral parts of the nose.

2. The *Orbital Processes*, which form the inferior margin, the inferior portion, and the inferior fissure of the orbits.

3. The *Jugal* or *Zygomatic Processes* continued from the *Ossa Jugalina*.

4. The *Palatine Processes*, which are conjoined posteriorly with the *Ossa Palatina*, and make the anterior part of the palate.

5. The *Alveolar Arch*, which, if both bones be taken together, is composed of sixteen (*alveoli*) sockets, in which the teeth are contained. The posterior part, where there are no teeth, is called the *Maxillary Tuberosity* (59).

(59) The *Alveolar Arch*, or as it is oftener called, the *Alveolar Process*, of the upper and under jaw, is formed of two plates; one external, and another internal. These plates recede farther from each other as they approach nearer to the maxillary tuberosity; and are connected together by thin bony partitions going from one to the other, so as to form the *alveoli*. The transverse partition is higher than the anterior and posterior plates of the alveolar arches. As the alveolar processes are rather appendages of the teeth than of the jaws, which will be amply explained hereafter, the osteogeny of them can hardly be separated from that of the teeth (See Note 81. and what follows it.).

6. The

6. The *Nasal Spine*, formed interiorly by the junction of the two maxillary bones, in the cavity of the nose. The *Septum* of the nose and its cartilaginous part adheres to the nasal spine.

The *Cavities* and *External* and *Internal Foramina* are these, viz.

1. A *Large Notch*, for the cartilaginous part of the nose.

2. A *Furrow*, in the superior and internal part of the nasal apophysis, near the orbit, for the lachrymal sac. This furrow, inferiorly constitutes a part of the nasal canal which opens into the cavity of the nostrils.

3. The *Infra-orbital Foramen*, or *Anterior* or *Exterior Orbital Foramen*, is the opening of a canal, immediately under the inferior margin of the orbit, which runs to the orbital apophysis, terminates posteriorly near the inferior orbital fissures in the *Posterior Orbital Foramen*, and transmits the inferior orbital nerve.

4. The *Anterior Palatine Foramen*, in the anterior part of the palatine apophysis, behind the *Incisores* teeth. It opens superiorly at the nasal spine, and is the passage of the anterior palatine artery, together with the membrane of the palate continued into the cavity of the nostrils.

5. *Various Small Foramina* in the maxillary tuberosity, through which the anterior alveolar nerves pass, from the inferior orbital nerve.

6. A

6. A *Small Depression* in the same place, to which the wing of the palatine bone is affixed. Near this depression, there is likewise a *Furrow*; which, together with the palatine and sphenoidal bones, constitutes a canal; the end of which is called

7. The *Posterior Palatine Foramen*. It is placed behind the last of the *molars* teeth, in the maxillary tuberosity, being the passage of the posterior palatine nerve.

8. The *Sockets*, of which there are seven or eight on each side ⁽⁶⁰⁾.

9. The *Transverse Eminence*, between the bottom of the nasal canal and the mastoid apophysis; to which the anterior part of the inferior portion of the squamous bone adheres.

10. The *Maxillary Sinus* or *Higmore's Antrum*, which is a large cavity in the middle of this bone, extended superiorly under the orbit as far as its inferior fissure, and inferiorly as far as the *alveoli*. The orifice of this *antrum* in the nose is partly covered by the inferior spongy bones and *ossa palatina*; and hence it is rendered so small as scarcely to admit a goose's quill ⁽⁶¹⁾.

The

⁽⁶⁰⁾ Although we have observed above ⁽⁵⁹⁾, that as the bony partitions connect the external and internal plates of the alveolar processes, they also form the sockets of the teeth, or *alveoli*; yet we ought to mention, in this place, that whenever a tooth has many fangs, there are always an equal number of distinct *alveoli*.

⁽⁶¹⁾ This cavity or *antrum* is seldom wanting, though that it is sometimes, is asserted by Morgagni (*Advers. Anat.*

The bones now described are connected to each other, and with ten more : viz. with three bones

Anat. VI. p. 116.). Its figure is somewhat triangular. Its length is nearly two inches, from its fore-part backwards. In depth, it is more than an inch. Cowper says, it may be best seen by dividing the bone near the *dentes molares*. It is called by Julius Casserius *Antrum Genae*.

This *Antrum Maxillæ Superioris*, as Highmore called it (*Disq. Anat. Lib. 3. Part II. Cap. I.*), is perfectly formed at birth, though not so large, in proportion to the magnitude of the bone, as in adults. Besides, there is no part of it covered by the *os palati* at birth (*Nesbitt's Hum. Ost.*). Fallopius said it is wanting in children (*Observat. Anat.*). This cavity is lined with a continuation of the same pituitary membrane that lines the nostrils.

The bottom of this *antrum*, which is a covering to all the roots of the *dentes molares*, and of the *dens caninus* of the same side, is so very thin as frequently to be broken in drawing any tooth under it, producing an opening thereby into the mouth. Dr. Highmore saw an instance of this, and Cooper saw many; but none in which the opening did not close again, after the injection of a proper medicine.

Accumulations of matter have been discharged from the *antrum*, by first extracting the foremost *molaris* tooth, and boring into the *antrum*, unless it were opened by the removal of the tooth. Thus, whatever was injected into the *alveolus*, returned by the nose, so that the patients were speedily and safely cured, as Cowper affirms.

Mr. Hunter observes, that this *antrum* is very subject to inflammation and suppuration, from diseases of adjacent parts, particularly from an obstruction of the duct leading to the nose. He doubts whether it be a cause or an effect, but properly says, that if it be a cause, the inflammation of the *antrum* may be induced by a mere accumulation of the natural mucus irritating and distending for its exit; as an obstruction to the passage

of

bones of the skull, 1. the *os frontis*, 2. the *os ethmoides*, 3. the *os sphenoides*, to six bones of the face, 4. the *os nasi*, 5. the *ossa lachrymalia*, 6. the *ossa jugalia*, 7. the *ossa palatina*, 8. the *ossa spongiosa*, 9. the *os vomer*, and, lastly, 10. the teeth.

Their Use. They make a part of the orbits, palate, face, and nostrils. They serve also in the secretion of the *mucus* of the nose, in chewing, and in retaining and strengthening the teeth.

of tears through the *ductus ad nasum* causes an abscess of the lachrymal sac.

The symptoms of this abscess are hardly to be distinguished from the tooth-ache, in the beginning; but the nose, eye, and that part of the forehead over the frontal sinus, is commonly more painful than in tooth-ache. The disease generally continues longer than tooth-ache, and the cheek at length becomes red and hard above the roots of the teeth. Mr. Hunter, however, confesses with no less candour than judgment, that the symptoms are ambiguous.

The cure is not to be effected by making an opening through the cheek, but as mentioned above, by drawing a tooth, and evacuating the matter by the *alveolus*; or by perforating the *antrum* through the *septum*, which divides it from the nose. But, if the anterior part of the bone be destroyed, an opening may be made on the inside of the lip, where the abscess will most likely be felt; and this opening must be prevented from healing by apposite means. The first method is the best (Hunter's Pract. Treat. on the Diseases of the Teeth, Chap. I. Sect. VII.).

The

The Offa Nasalia.

The two *Offa Nasalia* cohere to each other, at the base of the *os frontis* in the anterior and middle part of the nose.

The *Figure* of these bones is like that of an oblong quadrangle.

We may notice of each bone

Its *Two Surfaces*, and

Its *Four Margins*.

The *External Surface* is convex, and inclined somewhat inwards, forming the ridge of the nose.

The *Internal Surface*, which is concave, is turned towards the cavity of the nostrils.

The *Superior Margin* is thick but narrow, extending even to the *os frontis*.

The *Inferior Margin* is thin, broad, and denticulated. It unites to the cartilages of the nose.

The *Internal Surface* is smooth and connected with its corresponding bone, by harmony. Internally it has a small eminence, to which the *septum narium* adheres.

The *External Surface* is conjoined with the nasal apophysis of the superior maxillary bone.

Each of these bones has a *foramen* at its superior extremity, which is a passage alike for nerves and blood-vessels.

They are joined together by harmony; but they are likewise joined to three other bones: viz.

1. The

1. The *Os Frontis*.
2. The *Os Maxillare Superius*.
3. The *Os Ethmoideum*; by means of the internal margin.

Their *use* is to form the nose, and to defend the organ of smelling (⁶²).

The Offa Lacrymalia.

The *Offa Lacrymalia* or *Offa unguis*, are the least and thinnest bones of the face. They are called *Lacrymalia*, because the tears flow over them into the nostrils; and *Offa Unguis*, because they resemble somewhat the nail of one's finger, in size and form. Each bone is situated on one side of the orbit, at the inferior part of the internal angle.

Their *Figure* is almost quadrangular.

We may observe in each

An *External Concave Surface*, turned towards the orbit.

An *Internal Convex Surface*, next to the *os ethmoides*.

Four Margins: viz.

One, *Superior* connected with the *os frontis*,

Another, *Inferior* connected with the superior maxillary bone,

(⁶²) The *Offa Nasalia* at birth are perfectly formed, differing from those of adults only in the roughness and porosity of their internal surfaces. Their connections are membranous (Nesbitt's Hum. Osteog.).

A third,

A third, *Internal* connected with the thin plate of the *os ethmoides*,

The last, *External* connected with the nasal apophysis of the superior maxillary bone, having a furrow in the middle, which, together with a semi-canal of the afore-mentioned apophysis, forms a *fossa* for the nasal canal.

The *Connection* is made with four bones: viz. 1. the *os frontis*, 2. the superior maxillary bone, 3. the ethmoid bone, 4. the inferior spongy bone.

Their *Use* is, to make a *fossa* for the lacrymal sac and nasal canal, to be a part of the orbits, and to cover the labyrinth of the nose ⁽⁶³⁾.

The Offa Zygomatica.

The *Offa Jugalia*, or *Zygomatica*, or *Offa Malae*, are placed superiorly on each side of the face ⁽⁶⁴⁾.

Their *Figure* is unequally quadrangular.

They are divided into an *External* convex surface, and an *Internal* concave surface, of which the greater part of the zygomatic *fossa* is made. They are divided also into a *Body* and *Four Apophyses*: viz.

⁽⁶³⁾ These bones are completely formed at birth.

⁽⁶⁴⁾ *Offa Malae* is a name assigned by Celsus to the upper jaw only (*Lib. VIII. Cap. I.*); and *Maxilla* only to the lower jaw.

1. The *Frontal Apophysis* or *process*, which is annexed to the *os frontis* at the external angle of the orbit.

2. The *Orbital Apophysis*, forming a part of the orbit.

3. The *Malar Apophysis*, joined to the superior maxillary bone.

4. The *Zygomatic Apophysis*, which connected to the zygomatic apophysis of the temporal bone, forms the *Zygomatic Arch*.

The *Foramina* and *Cavities* of the *Ossa Zygomatica* are these: viz.

1. *Various Foramina* in the external surface, which are the passage of nerves and blood-vessels.

2. The *Zygomatic Fossa*, under the zygomatic arch.

Each bone is connected with four others: viz. 1. the *os frontis*, 2. the *os maxillare*, 3. the *os temporale*, 4. the *os sphenoidale* ⁽⁶⁵⁾.

The *Use* of each of these bones is, to support the superior maxillary bone, to form the face, and the inferior and lateral part of the orbit.

The Ossa Palatina.

The *Ossa Palatina* are situated posteriorly in the superior part of the palate, between the pterygoid apophyses and the superior

⁽⁶⁵⁾ At birth, they are the same as in adults; except that they have no indentations at their edges, for their better connection with the contiguous bones.

maxillary bone ; at the sides of which, in the posterior part of the nostrils, they ascend as high as the orbits.

Their *Figure* resembles an irregular triangle. They are incurvated upwards, and their surface is unequal, because of various eminences and cavities.

Each bone is divided into four regions : viz. 1. the *Palatine*, 2. the *Pterygoid*, 3. the *Nasal*, 4. the *Orbital* ; all of them having their surfaces and margins.

The *Palatine Region* is placed posteriorly, It has an *Anterior Margin*, which is connected to the palatine part of the superior maxillary bone ; and a *Posterior*, which is somewhat curved, and forms the roof of the palate and the cavity of the nose. The *columnella*, the soft palate, and its various muscles adhere to this margin.

The *Union* of both bones makes a rough line in the superior surface ; in the middle of which, there is a *Sulcus* for the attachment of the *vomer*. There is too a similar *sulcus* in the inferior surface.

The *Pterygoid Region* is called by some the *Pterygoid Process*. It is situated inferiorly and posteriorly between the *alae* of the sphenoid bone and the maxillary tuberosity. It is unequal, its sides being pressed inwards, and divided from the palatine and nasal regions by a furrow, the end of which furrow is called the *Posterior Palatine Foramen*, because a branch of the palatine nerve passes through it.

it. Near this *foramen*, there are two other small openings, in which is terminated the end of another passage, which is also destined for a branch of the palatine nerve.

The *Nasal Region* is the thinnest of all. It ascends laterally, having two surfaces; one *Internal Surface*, turned towards the nose, and separated by a prominent line from the palatine region, on which the posterior part of the inferior spongy bone rests; and another surface called *External*, which is against the orifice of the great pituitary sinus, which is partly covered by it.

The *Orbital Region* is separated from the nasal by a notch, which, uniting with the *alae* of the sphenoid bone, forms an aperture called the *Spheno-palatine foramen*. This region externally and laterally covers the orifice of the pituitary sinus of the superior maxillary bone. It sends an *Apophysis* superiorly, to the posterior part of the orbit, which is called *Orbital*.

The *Ossa Palatina* are joined with two bones of the skull: viz. 1. the *os sphenoideum*, 2. the *os ethmoideum*; and with three bones of the face: viz. 3. the superior maxillary bone, 4. the inferior spongy bone, 5. the *os vomer*, 6. and, lastly, they are joined to each other ⁽⁶⁶⁾.

As

⁽⁶⁶⁾ These bones are larger in proportion to the palate in foetus, than in adults; but they acquire the form of adult bones three months after conception, when

As to their *Use*, they form the posterior part of the palate, and nose, and a small part of the orbit. Moreover, they partly cover the pituitary sinus of the inferior *maxilla*.

The Os Vomer.

This bone is so called, because it is like a plough-share. It is a single bone, situated perpendicularly in the middle of the nose, dividing it into two parts.

We may observe of the *vomer*,

Two Surfaces; one the *right*, another the *left*, both facing the cavity of the nostrils.

Four Margins; a *superior*, an *inferior*, an *anterior*, and a *posterior* margin.

The Superior Margin has a long furrow, to receive the sphenoid bone.

The Inferior Margin enters the canal of the *ossa palatina* and *maxillaria superiora*.

The Anterior Margin is divided into two *lamellae*, by which the perpendicular *lamella* of the ethmoid bone, and the cartilaginous part of the nose is intercepted. The Posterior Margin is acute inferiorly, but becomes gradually more obtuse as it ascends, and, unconnected with the other bones, it is turned to the *fauces*. The *Os Vomer* is connected with four bones: viz. 1. the sphenoid, 2. the ethmoid, 3. the superior maxillary, 4. the

they can scarcely be separated from the membranes containing them (Nesbitt's Hum. Osteog.).

palatine,

palatine, and, lastly, with the cartilaginous *septum* of the nose ⁽⁶⁷⁾.

Its *Use*. It divides the nose. It supports and enlarges the organ of smelling.

The Offa Spongiosa Inferiora.

Both the *Inferior Spongy Bones* are placed in the inferior and lateral parts of the cavity of the nostrils. Anteriorly, they are connected to the transverse eminence of the superior maxillary bone; and posteriorly to the oblique eminence of the palatine bone, in such a manner, that they are above the aperture of the nasal canal, but below that of the pituitary sinus of the superior maxillary bone.

Their *Figure* is like that of a shell; as is that of the superior spongy bones, with which these very much agree in their aptness to break, their tenuity and size.

We observe in the *Offa Spongiosa Inferiora*

1. *Two Extremities*; of which the *anterior* is broader than the *posterior*.

2. *Two Margins*; the *inferior*, larger, and thicker of which is placed freely in the cavity of the nostrils: the *superior*, which is thinner, resting anteriorly on the transverse eminence, already noticed, of the superior

(67) At birth the *Vomer* consists of two distinct *lamellae*, which are porous and unconnected with each other; except inferiorly, where the *vomer* unites with the *ossa palatina* and *ossa maxillaria superiora*.

maxillary bone, and posteriorly on the oblique line of the palatine bone.

3. *Two Surfaces*; the external of which being concave, is opposite the pituitary sinus of the superior maxillary bone; the internal, which is convex, being turned towards the *septum* of the nose.

4. *Two Apophyses*; a *less*, which ascends perpendicularly, and forms a small furrow at the end of the nasal canal; and a *greater*, which goes in the course of the superior margin of these bones, covering a part of the aperture of the pituitary sinus of the superior maxillary bone ⁽⁶⁸⁾.

The *Substance* of these bones is made up of very thin, spongy *lamellae*, covered by a pituitary membrane.

Each is connected with three bones: 1. the superior maxillary bone, 2. the palatine bone, 3. the lacrymal bone.

⁽⁶⁸⁾ It has already been observed ⁽⁵²⁾, that there are sometimes three turbinated bones in each nostril; the middle one being always the largest, and the lowermost the smallest. The lowermost spongy bones, noticed by Cowper, seem to be continued from the sides of the maxillary *sinus*. Professor Scarpa says the *ossa turbinata inferiora* have no *foramina*, are firmer than the superior, and uneven, because of (*foveoli*) little pits and eminences. He also notices two canals of these inferior spongy bones, the one superior, and the other inferior (*Anatomic. Annot. Lib. II. De Org. Olfact. &c. pag. 13.*).

The *Ossa spongiosa inferiora* are as much formed, at birth, as the *superiora*. Dr. Nesbitt could never discover any ossification of these parts till nearly five months after conception; when it advances so rapidly, as to be equally as perfect at six months as at nine.

Their Use. They encrease the surface of the pituitary membrane, and, consequently, enlarge the organ of smelling. They form the extremity of the nasal canal, and diminish the opening of the *Antrum Highmorianum*.

The Lower Jaw.

The *Inferior Maxillary Bone* or *Lower Jaw*, occupies the lowermost and foremost part of the face and head. It is the largest bone of the face: in figure it somewhat resembles a horse-shoe. In adults it is only one bone, but in *foetus* and delicate children it is composed of two.

It is divided into

1. Its *Body*, or Anterior and Middle Part, called the Chin.

2. Its *Superior* and *Inferior Margins*: in the former of which there are sixteen conoid holes, called *Alveoli*, and as many teeth fixed in them by means of fangs variously formed. The *Inferior Margin* is subdivided into its external and internal ridges. .

3. Its *External* and *Internal Surfaces*, in which the *Maxillary Foramina* may be observed.

4. Its *Two Extremities*, which are flatter than the body, each resembling an irregular triangle.

The *Eminences* of the Lower Jaw are these: viz.

1. The *Coronoid Process*, placed anteriorly, is flat and broad below, and terminated in a

pointed extremity. The Temporal Muscle is attached to this process.

2. The *Condylloid Process*, situated posteriorly, is extended into an oblong condyle, covered with cartilage, and received into the articular cavity of the temporal bone, almost transversely (see note 43). Beneath this condyle or head is placed the *Neck*, which is inclined somewhat backwards, having a depression for the insertion of the small pterygoid muscle (⁶⁹).

3. The *Angles* of the lower jaw are placed at the extremities of the inferior margin, where the jaw bone is bent upwards, on each side.

4. The *External* and *Internal Spines* of the Chin, which are nothing but lines externally and internally at the symphysis of the jaw.

The *Cavities* and *Foramina* are

1. The *Great Semi-lunar Notch*, between the coronoid and condylloid processes.

2. The *Posterior Maxillary Foramen*, on the internal surface, under both processes. It is the beginning of a canal which passes forwards through the maxillary bone.

(⁶⁹) Morgagni (*Advers. Anat.* II. Fig. 1, 2, 3.), Monro (*Edinb. Med. Essays and Obs.* Vol. I. Art. II.), and Hunter (*Nat. Hist. of the Hum. Teeth*, Part I.) have treated particularly of the articulation of the lower jaw with the temporal bone. The last has given a very accurate plate of it. We have said enough, in various places, to serve at present. They who are desirous to understand it more fully, may consult the writers above cited.

4. The

4. The *Alveoli*, above mentioned, in the superior margin, which are sixteen in number (see note 60).

The *Substance* of the lower jaw is externally compact, but internally spongy.

The Lower Jaw is connected with the articular cavity of the temporal bone by *arthrodia*, and with the *os hyoides* by *syllarcosis*.

It is of *use* in chewing, speaking, and forming the face more beautiful. It contains sixteen teeth, and many soft parts (⁷⁰).

Of the Teeth.

The Teeth are fixed, one after another, in the upper and under jaw, in such a manner, that in an adult, there are naturally sixteen belonging to each. Hence the number of the teeth is universally thirty-two (⁷¹).

They

(⁷⁰) Besides being in two distinct pieces at birth, connected together by membrane, the condyloid process is much shorter than in adults, considering its proportion to the lower jaw; and the inter-articular cartilage is more like a thick ligament. The coronoid apophysis is also shorter.

The two bones are composed of two thin sides joined only at their bottom, the external *lamella* being more porous and unequal than the internal. The cavity within these sides is divided into five separate cavities by bony partitions.

The Posterior Maxillary *Foramina* are more backwards than in adults.

(⁷¹) Mr. Hunter once saw only twenty-seven; and says, that when the whole number is only twenty-nine or thirty-one, the upper jaw sometimes, and sometimes the lower has more. Nay, he found sixteen in one jaw and only fourteen in another (Nat. Hist. of the Hum. Teeth, p. 46.). Hippocrates and Galen accounted the greater size and number of teeth a sign of longevity; but

They are small, yet the hardest bones of the body. The middle and broader part of a tooth, which protrudes without the socket, is called its *Body*; and the uppermost part of the body is called the *Crown* of a tooth. The part which is hidden within the socket, and terminated in a wedge-like extremity, is named the *Fang*. Each fang has a small *foramen* in its extremity, by which the artery, vein, nerve, and internal *periosteum* pass into the little cavity in the substance of the teeth. The circle between the crown and fang of a tooth, is denominated its *Neck*, or *Collar*.

The Teeth are divided into three classes or orders, *viz.*

1. The four anterior, middlemost, broad and sharp teeth, are the *Incisores*.

but it is amply proved by Scaliger (*Exerc. 271. contra Cardanum.*) that a short life cannot be foretold from few teeth, even when they are small and rugged.

Pliny relates more than one instance, where there were two ranges of teeth instead of one, as doth also Valerius Maximus (*Lib. I. Cap. 8.*); and Columbus says that his own son had three ranges (*De Re Anatomica.*). Sabatier, who has seen similar cases, always observed that the jaw was enlarged; and that in such instances, it was owing to the canine teeth being placed behind the *incisores* and first *molars* (*De l'Osteol.*).

Albinus found a tooth implanted in that part of the maxillary bone which unites with the *os palati*; it did not project into the mouth, and he discovered it by chance (*Annot. Acad.*). Sabatier saw an instance of two canine teeth arising near each other, which pressed the middle of the tongue, and were very troublesome (*De l'Ost.*).

Sometimes there are no teeth, but in their stead one equally extended bone (*pro superiori ordine dentium unum os aequaliter extensum*), as is told by Valerius Maximus (*Lib. I. Cap. 8.*) of Prusias, the son of the king of Bithynia, in whom, upon this account, there was neither deformity nor inconvenience.

2. The

2. The two next, one on each side, are called *Canine*; and the canine teeth of the upper jaw are called the *Eye-teeth*.

3. Next the canine teeth posteriorly, there are five teeth on each side, called *Grinders* (72). The two last of which are called *Dentes Sapientiae*, because they are generally formed after the rest (73).

The *Four Incisores*, so called from their use, are smaller and narrower in the lower jaw than the opposite four of the upper jaw. The *Crown* of these teeth is broad, sharp, and in children often denticulated. Their *Root* is short, laterally broad, smooth, and ended in a single, obtuse extremity (74).

The *Crown* of the *Canine Teeth* is thicker than that of the *Incisores*. Anteriorly they are convex; posteriorly they are made round and terminated in an obtuse apex. Their

(72) Mr. Hunter, considering the form, and use, and growth of the teeth, has chosen a division different from that in the text. He retains the name *Incisores* or *Fore-teeth*. He calls the canine teeth *Cuspidati*. He distinguishes the two first *molars* by the appellation of *Bicuspidates*, and gives the name *Molars* only to the three last. Hence, in each jaw, he enumerates four *Incisores*, two *Cuspidati*, four *Bicuspidates*, and six *Molars*.

(73) The *Dentes Sapientiae*, according to Diemerbroeck, are also called *Dentes Genuini*, or *Dentes Morum* and *Intellectus*.

(74) Those of the Upper Jaw protrude farther outwards, and are commonly so placed as to cover in part those of the under jaw. The ossification of the *incisores* begins at three points, according to Mr. Hunter, the middlemost being the highest, and the first that begins to ossify (page 88.).

Root

Root is longer and more acute than that of any other teeth; hence those of the upper jaw often penetrate the maxillary sinus⁽⁷⁵⁾.

The *Grinders* differ in size, the *anterior* being less than the *posterior*.

The *Crown* of the grinders is a broad surface, irregular, with more or fewer eminences; the apex of the anterior grinders is commonly less, and only double, but that of the posterior is much larger, and threefold, fourfold, or fivefold.

The *Roots* of the grinders are long, but less smooth. They are single, double, triple, quadruple, though rarely quintuple. They are straight or crooked. They are grown together, or not⁽⁷⁶⁾.

The

(75) The *Canini Dentes*, or *Cuspidati*, are not exactly in the arch of the jaw, they project somewhat from it. Hence the four *Incisores* and two *Cuspidati* are almost in a right line. This is more remarkable in the lower jaw. The enamel being, as it were, separated from the sides of the *incisores*, led Mr. Hunter to compare the seeming effect of the fang of these teeth in separating the enamel to that of a wedge. The *Cuspidati* differ from the *Incisores*, their sides and edges being covered with enamel. Mr. Hunter says the *cuspidati* have only one point of ossification.

(76) The first of the grinders, or the former *bicuspid* is not much unlike the canine tooth next it, Both *bicuspid*es have less enamel laterally than the *cuspidatus*, but more than the *incisores*. Mr. Hunter, says, that the *bicuspid*es, and especially the second of both jaws, are oftener naturally wanting than any of the teeth, except the *dentes sapientiae*. He thinks they are less useful, considering them of a middle nature between *incisores* and *molar*us

The *Substance* of the teeth is compact (77). The external surface of the crown, is covered with a singular, thin, white, and polished substance, like glass, which is called the *Enamel* or *Vitreous Crust*. It surpasses in firmness and solidity the most compact substance of bones (78).

The

molars (p. 57.). They have an external and internal point of ossification only.

The difference of the *Bicuspid*es and *Molars* of Mr. Hunter consists in the greater size of the latter, the greater number of fangs, and the further division of the crown into points.

The *Molars* of Mr. Hunter are covered uniformly, on all sides, with enamel; and have four or five points of ossification, the external being always first formed.

Mr. Hunter has observed that all the teeth have but one fang, except the grinders, each of which has two fangs in the lower jaw, and three in the upper. He imagines those anatomists to have fallen into a mistake, who supposed the teeth to have more fangs, because whenever they saw too canals in one fang, they concluded that such fang was composed of two, grown together.

(77) Bartholine confesses there are peculiarities in the substance of teeth, yet does not think they should be excluded from the number of bones (*Anat. Reform.*). Independent of its hardness, it has no vessels, at least none capable of admitting coloured liquors. It is not renewed, like bone, nor does it like bone unite by *callus*. It is not altered by other diseases, Rickets and *Mollities Ossium* not excepted. The substance of teeth is nevertheless formed of *lamellae*, as Mr. Hunter discovered by softening it in acids, and unravelling it, and by feeding animals on madder (p. 92.).

(78) The Enamel is thickest on the *Corona dentis*; it is thinner, where it suffers less friction; and it is wholly discontinued at the neck of the tooth, according to Mr. Hunter (p. 33, and 43.). Marherr asserts that

The teeth are fixed in the *alveoli* by gomphosis⁽⁷⁹⁾, so that each tooth naturally fills up its appropriated socket, which is separated from the next by an intermediate thin, spongy partition. Moreover, the gum closely embraces the neck of the tooth.

The Teeth are destined for chewing; for the *Incisores* cut and divide the food; the *Canini* tear it into smaller pieces, and the *Molares* break and grind it. Besides, the teeth render the pronounciation of some letters

that enamel is continued even over the fang, though it be much thinner there (*Praelect. in Inst. Med. Boerb. § LIX.*). The latest and most accurate experiments of Mr. Hunter prove, that the most subtile injections never reach the enamel; though Ruysh (*Thesaur. X. No. 27.*) and Monro (*Osteol. p. 155.*) had both supposed it possessed of vessels (See the sequel of Note 81).

If enamel be broken, it appears as if it consisted of fibres. These fibres, which anatomists had long since observed, are said by De la Hire to be short, closely compacted together, and placed perpendicularly to the interior substance of the tooth (*Mem. de l'Acad. des Sciences, An. 1699.*); Bertin found them variously inclined (*Osteol.*); Havers says the fibres lie obliquely on the tooth (*Ost. Nov. p. 79.*); and Mr. Hunter, whom I take to be in the right, remarks that they are directed from the circumference of the tooth to the center (p. 33.)

Enamel is so hard as scarcely to be filed. It strikes fire with steel.

The Chemical *Analysis* of the Teeth and of the Enamel is to me a *Desideratum*.

(79) The teeth frequently become loose and fall out, in scurvy, mercurial salivation, &c. they fall out by boiling and maceration; the *molares* excepted; and they have a motion in their *alveoli* naturally. Ought we not rather to call their connection *Syffarcosis*?

more

more distinct (⁸⁰), and are an ornament to the face.

There remain even now to be particularly noticed of the teeth the circumstances which follow, *viz.*

In *foetus*, and children soon after birth, a double order of teeth is hidden in the *alveoli* by the gums, and separated one from another by a thin bony *lamella*. The superior protrudes through the gums six or seven months after birth; sometimes, however, not till a whole year hath elapsed; but in such a manner, that the *Incisores* first, one or another of the *Molares* next, and last of all the *Canini* are formed.

The Teeth above-mentioned are called *Primary* or *Milk-teeth* (⁸¹): they gradually fall out

(⁸⁰) Perhaps the *Incisores* only render the voice more clear and sonorous; for the change is remarkable when these, or any of them, are removed. Children are said to lisp, till these are formed; and old men who have lost them, mouth every thing they say, and experience a greater difficulty as these and the alveolar processes are removed. The particular letters which cannot be pronounced but for the teeth, are said by Bartholine to be T and R (*Anat. Reform.*); to which Diemerbroeck adds C, D, L, X, Z (*Anat. G. H.*).

(⁸¹) These *Primary*, *Temporary*, or *Milk-teeth*, as they are called, differ from those which succeed them in number, figure, and size. There are only twenty; there being no *Bicuspidetes*. The *Incisores* are formed generally before the ninth month after birth; but all the teeth are commonly seen about the twentieth or twenty-fourth month. The figure and size of the milk teeth was said to differ from that of the secondary teeth; because of the circumstances

out about the seventh year, and are succeeded by the other order, which till now had been concealed

circumstances attending the *Shedding of Teeth*; it was imagined that the secondary teeth are rendered broader and thicker from the resistance given them in removing the primary teeth. This is merely hypothetical, as Mr. Hunter observes; for the secondary *bicuspid*es are less than the primary (p. 106.). The more rational account of the shedding of the teeth is likewise given by Mr. Hunter; he avers that the second set of teeth do not push out the first, but that the second set is formed in distinct sockets, and that the fangs of the first set gradually decay, as the succeeding teeth grow. That this doth not depend on the constant pressure from below, is evident from this, that the decay of the fangs of the first set is always in proportion to the decay of the first sockets, and the new teeth arise in new, distinct sockets. Nay, the secondary teeth are enclosed in their *alveoli* after the primary ones have fallen, and consequently are not injured by pressure (p. 98.).

Mr. Hunter never saw but one instance of a third set of teeth, in the same person, and in that two fore teeth appeared in the lower jaw; he thinks a new alveolar process must necessarily be formed in such cases; and says the age at which this third dentition happens is about seventy (p. 84.). It certainly happens afterwards, if one can safely believe the reports of learned men; at eighty, ninety, a hundred, and a hundred and twenty (Van Swieten, *Com. in Aph. Boerb. Tom. IV. p. 42.*). See also Sennertus (*Prax. Med. Lib. II. P. I. Cap. 10.*) and Dodonaeus (*Obs. Med. p. 291.*). And we have an instance in the Lond. Med. Obs. and Inq. Vol. 3. of a third set in a child only five years old. But the third set was only in the upper jaw.

Of the Formation of the Alveoli, and Teeth, their Bony Part and Enamel.

In foetus of three or four months old, there are no bony partitions between the anterior and posterior surfaces of the

concealed in the bottom of the *alveoli*. These latter teeth usually remain the rest of one's life-

the alveolar process; but instead of them, there are ridges across the bottom of the longitudinal groove, with intermediate depressions, marking the beginnings of future *alveoli*.

There is no distinct canal yet, for the blood-vessels and nerves of the lower jaw; but a mere groove at the bottom of the alveolar cavity (See Note 70).

The ridges which are to form the partitions of the *alveoli* extend upwards on the internal surfaces of the anterior and posterior plates of the alveolar process, and shoot across from the sides, forming arches: and as the intercepted cells become deeper, their apertures contract, and are at length almost closed. This contraction seems to answer a good end; it supports the gum till the teeth are come through. The *alveoli* of the three last grinders are formed after a different manner. They are formed in the root of the coronoid process of the lower jaw, and in the tubercles of the upper jaw; so that they come forwards in proportion as the body of the lower jaw comes forwards, from under that process.

So much for the *alveoli*: we are next to speak of the *Teeth*; the rudiments of which, in foetus of three or four months, are, according to Mr. Hunter, four or five little pulpy substances, contained in the beginnings of the *alveoli* (p. 77.). Each pulp is of a firm texture, transparent and very vascular. It is attached only at the bottom of the cavity which forms the *alveoli*, and there the vessels enter. The pulp having become almost as large as the body of the tooth, ossification commences, but the pulp does not immediately cease growing (p. 86 and 87.).

The pulpy substances are loosely invested with a thin *capsula*; which if sought for, in a recently born child, is found easily separable into two membranes; the external of which is soft, spongy, but not vascular; it adheres to the gum where it covers the *alveoli*; the internal membrane is firmer and very full of vessels; which it receives from those that go to the pulp and body of the

life-time, unless they be affected with disease. The two last of this latter order, which appear the

tooth (p. 87.). Between this pulp and membranous capsule, there is a liquor like *synovia*.

The *capsula* is necessarily perforated when the tooth has come through the gum; and as its lower part encompasses the neck of the tooth, it is gradually removed as the tooth is completed (p. 87.).

Now the points of ossification appear in one, or in many parts, on the surface of the pulp. If there be only one point of ossification, it enlarges till the tooth is formed. If there be many, they all increase, till they meet and unite; when they become as one point of ossification, extending and covering the whole pulp (p. 88.). In the progress of ossification, that part of the pulp is always the more vascular, which is covered with bone; though the bony part cohere so slightly to the pulp as to be easily separated from it, without any seeming laceration (p. 89.).

The pulp, which bears a resemblance to the body of the tooth, being covered with bone, contracts, and thus forms the neck; after which the fang begins to be formed, and raises the body of the tooth against the top of the socket, which is consequently rendered thin; and at length, both it and the gum which covered the socket, are removed (p. 89.). There is no part of the pulp which corresponds with the fang of a tooth; but we can readily conceive how that defect is compensated: for as the cavity in the body of the tooth is gradually lessened, a part of the pulp is gradually forced out, and elongated and formed into a fang. As this fang passes deeper into the socket, the tooth is proportionally protruded. But the socket also accommodates itself to the beginning of the fang, or neck of the tooth; it contracts around the incipient fang, and passes along with it; whilst the *alveolus*, which contained the body of the tooth, is contracted in its whole length, over the fang; or is absorbed, to make room for another (Hunter *ibid.*).

There is only one cavity in the body of any tooth; and if it have more fangs than one, the ossification shoots from

the latest, are called *Dentes Sapientiae*, as already observed.

Hitherto,

from opposite sides; both or all meeting and dividing the opening of the cavity in the middle of the tooth, from each of which divisions the fangs grow.

If there be three fangs, ossification proceeds from three points of the circumference, which converge to a center, so as to make three apertures to the cavity in the body of the tooth; and from the edges of these apertures the fangs are formed.

The *Enamel* is not formed before the bony part of a tooth. Mr. Hunter says,—“There is another pulpy substance opposite to that which we have described; it adheres to the inside of the *capsula*, where the gum is joined to it, and its opposite surface lies in contact with the basis of the above described pulp, and afterwards with the new formed basis of the tooth; whatever eminences or cavities the one has, the other has the same, but reversed, so that they are moulded exactly to each other (p. 94.).”—Again,—“The best time for examining it is in a Foetus of seven or eight months old. It is thinner than the other pulp, decreases as the teeth advance, but does not seem to be possessed of many vessels (p. 95.).”—As soon as the bony part of a tooth is formed, it is covered with a thin coat of enamel, which encreases in thickness, till some time before the tooth begins to cut the gum. The enamel is perhaps secreted from the pulp above described, and the *capsula* of the body of the tooth; after it is secreted it crystallizes; hence we see the cause why it appears striated when broken (p. 95 and 96.). Where the enamel is first formed there it is always thickest; and it is thinnest at the neck; for there is no enamel on the fang (p. 96.).

The *Cavity of Teeth*, which is like that of the body superiorly, but gradually contracted inferiorly towards the opening at the extremity of the fang, is not cellular, nor does it contain marrow, but is smooth, and filled with blood-vessels, and nerves, connected together by cellular substance.

Hitherto, we have particularly considered the bones of the head; it is now convenient to recapitulate, as briefly as may be, the history of some of its parts taken conjointly.

Of the Nostrils.

The *Organ of Smelling*, which is universally called the *Nose*, is composed of the fourteen following bones, viz.

1. *Ossa Nasi*
2. *Ossa Maxillae Superioris*
3. *Os Frontis*

Superiorly, Internally and Laterally,

4. *Os Ethmoides*.

5. *Ossa Lacrymalia*, and

Inferiorly, Internally and Posteriorly, the *Ossa*
Maxillae Superioris; and

6. *Ossa Palatina*

The *Blood-vessels* come from the superior and inferior maxillaries.

The *Nerves* come from the second and third branches of the *Trigemini*, or Fifth Pair. Mr. Hunter was never able to trace the nerves distinctly even to the beginning of the cavity of the teeth (p. 42.): he acknowledges that the nerves of the teeth have an exquisite sensibility, more exquisite than other nerves; but he believes that the sensations of heat and cold are so extremely intense and momentaneous, because the teeth communicate heat quicker than other parts of the body (p. 114.).

There seem to be no *Absorbent Vessels* in the bony substance of the teeth; for if an animal, e. g. a pig, be fed alternately with madder and the ordinary food, the tinge will not be removed after ever so long a time; nor will any parts be tinged, except such as are formed while the animal feeds on madder (Hunter, p. 39.).

7. *Os Sphenoidale*

8. *Os Vomer*, which divides the nose into two cavities, in which are the

9. *Ossa Spongiosa Inferiora*.

The Nose itself is terminated anteriorly, in the face, and posteriorly in the fauces, by two orifices, which are named the *Anterior* and *Posterior Orifices of the Nose*; the latter are also distinguished by the designation of *Choanae Narium*. These cavities are much enlarged by the frontal, sphenoidal, superior maxillary, and ethmoidal sinus.

Of the Orbits.

The two *Orbits*, which contain the eyes, are composed of seven bones, viz.

Inferiorly, the *Os Jugale* and *Maxillare Superius*.

Superiorly, the *Os Frontis*.

Internally, the *Os Lacrymale*, *Ethmoidale*, and *Palatinum*.

Externally, and inferiorly, the *Os Sphenoidale*.

Besides, we ought to remark the two *Orbital Arches*; the *Superior*, which is continued from the *os frontis*, and the *Inferior* from the *os jugale* and *maxillare superius*. At the meeting of these arches, internally and externally, there are formed *Angles*: the greater of which is the *Internal Angle*.

The *Cavities* and *Foramina* of the Orbits are

1. The *Depression*, immediately over the external angle, for the lacrymal gland.

H 3

2. The

2. The *Little Pit*, superiorly in the internal angle, which concurs to form the *trochlea*.

3. The *Cavity* in the internal angle, for the lacrymal sac, formed of the *os lacrymale* and nasal apophysis of the *maxilla superior*.

4. The *Nasal Canal*, which is a production of the lacrymal cavity (3.), and opens into the nostrils under the inferior spongy bone.

5. The *Superior Orbital Chink* or *Fissure*, situated at the bottom of the orbit, is formed of the cuneiform bone. The third and fourth pair of nerves, and the first branch of the fifth pair, and the sixth pair, and the ophthalmic artery, all pass through it.

6. The *Inferior* or *Spheno-maxillary Fissure*, formed of the cuneiform bone, the superior maxillary bone, the palatine bone and the zygomatic bone. Blood-vessels and nerves pass through this fissure.

7. The *Optic Foramen*, in the bottom of the orbit, formed in the sphenoidal bone, through which the optic nerve passes.

8. The *Superciliary Foramen*, which is oftener a mere notch, on the internal part of the supra-orbital arch, and is the passage of the frontal nerve.

9. The *Internal Orbital Foramen*, or *Nasal Foramen of the Orbit*, placed in the internal part of the orbit, between the lateral lamina of the ethmoid bone and the *os frontis*. The nasal branch of the ophthalmic nerve passes through

through this *foramen* into the cavity of the nose.

10. The *Posterior Infra-orbital Foramen*;— in the posterior part of the orbit, there is a margin called the *Infra-orbital Canal*, which ends anteriorly, in

11. The *Anterior Infra-orbital Foramen*, which is under the inferior orbital arch. The infra-orbital nerve passes into the face through these *foramina*.

Of the Cavity of the Mouth.

The *Cavity of the Mouth* is formed by five bones, viz.

1. The Two *Ossa Maxillaria Superiora*,
2. The Two *Ossa Palatina*,
3. The *Os Maxillare Inferius*, and
Thirty-two Teeth.

Of the Cavity of the Fauces.

The *Cavity of the Fauces* consists of ten bones, viz.

Superiorly, the *Cuneiform Apophysis* of the *os occipitis*,

Inferiorly, the *Os Hyoides*,

Anteriorly, the *Pterygoid Apophyses* of the *os sphoenoidale*, and the *ossa palatina* and *os vomer*,

Posteriorly, the three superior *Cervical Vertebrae*,

Laterally, on each side, the *Petrous Apophyses* of the temporal bones.

The *External Eminences of the Head* are the following, viz.

In the *bones of the Skull*,

Two <i>Mastoid</i>	<i>Apophyses</i> ,
— <i>Styloid</i>	—,
— <i>Spinous</i>	—,
— <i>Pterygoid</i>	—,
— <i>Zygomatic</i>	—,
— <i>Articular Condyles</i> of the <i>os occipitis</i> ,	

The *Occipital Eminence* and *Spine*.

In the *bones of the Face*,

Two <i>Nasal</i>	<i>Apophyses</i> ,
— <i>Orbital</i>	—,
— <i>Palatine</i>	—,
— <i>Maxillary</i>	—,

The two last apophyses form the two arches, in which the teeth are contained; at their posterior extremity there is the *Maxillary Tuberosity*.

The *Nasal Spine*,

The Two *Articular Condyles* and *Coronoid Processes* of the lower jaw.

To the *External Foramina of the Head* are referred,

Two *Foramina of the os occipitis*,

— in the *articular condyles of the os occipitis*,

— between the *styloid* and *mastoid apophyses*,

— posteriorly in the *mastoid apophysis*.

Two *Meatus Auditorii Externi* in the *os temporum*,

Two *Eustachian Tubes* in the *ossa temporum*,
Two *Pterygoid Foramina* in the *os sphœ-*
noidale,

—— *Posterior Palatine Foramina* in the same
bone,

—— *Foramina* between the *os cuneiform* and
palatinum,

—— *Anterior Palatine Foramina*, in the su-
perior maxillary bones,

—— *Foramina* anteriorly, under the inferior
orbital arch.

———— in the inferior part of the
orbits,

———— in the zygomatic bones,

—— *Superciliary Foramina*, or Notches in
the supra-orbital arches,

—— *Nasal Foramina*, in the nasal bones,

—— *Anterior*, and

—— *Posterior Foramina* in the inferior
maxillary bone.

There are *Various Foramina* in the zygo-
matic bones; *Various Foramina* in the nasal
bones.

The *Internal Eminences of the Skull* are the fol-
lowing, viz.

The *Frontal Spine* of the *os frontis*; the
Crista Galli of the *os ethmoides*.

The *Two Lateral Alae* of the *Sphenoid* bone,

The *Four Sphenoidal Apophyses* of the *Sphœ-*
noid bone,

The *Two Petrous Apophyses* of the tem-
poral bones,

The

The *Internal Crucial Spine* of the *os occipitis*,

The *Internal Foramina* and *Cavities* of the skull are

The *Excavation* in the *sella turcica*, the seat of the pituitary gland,

The *Eight Depressions* for the brain and cerebellum.

The *Furrow* for the longitudinal sinus of the *dura mater*, in the *os frontis* and *os sincipitis*.

The *Two Furrows* for the lateral sinus of the *dura mater*,

The *Various Depressions* and *Furrows* made by the arteries,

Different small Foramina in the ethmoid bone,

Two Foramina, for the optic nerves, in the sphenoid bone,

The *Superior Orbital Fissure*, and

The *Inferior* ———, both in the sphenoid bone,

Two Foramina Rotunda in the sphenoid bone,

————— *Ovalia* in the same bone,

————— near the spine of the same bone,

————— *Lacera*, between the petrous apophysis and the *os occipitis*,

—————, in the petrous apophyses of the temporal bones, for the carotid arteries.

Two Meatus Auditorii Interni,

Two

Two *Foramina* anteriorly, in the articular condyles of the *os occipitis*.

The *Great Occipital Foramen*.

Of the Os Hyoides.

The *Os Hyoides* is a small, single bone, placed in the anterior part of the cavity of fauces, between the base of the tongue and the head of the *aspera arteria*.

Its *Figure* is femilunar,

It is *divisible* into

<i>A Body,</i>	and	} <i>Cornua.</i>
<i>Two Larger,</i>	and	
<i>Two Less</i>		

Its *Body*, or *Base* is the broad, thick, and middle portion, which is unequally protuberant forwards, but excavated backwards. It has

A Superior and *An Inferior Margin*; it has an *External* and an *Internal Surface*; and a *Right* and *Left Extremity*, for the attachment of the larger *cornua*.

The *Larger Cornua* are connected, on both sides, by their *roots*, to the body of the bone; they ascend at their *apex*, towards the styloid process of the *os temporale*, and are connected to it, and to the *cornua* of the thyroid cartilage posteriorly, by *syndesmosis*. Their *middle part* is broad and turned somewhat downwards.

The *Less Cornua* may be seen at the connection of the larger *cornua* with the body
of

of the bone. They are united to the base by a sub-cartilaginous ligament.

The *Os Hyoides* is connected by syndesmosis and splanchnosis: 1. with the head of the *larynx*; 2. with the styloid process of the temporal bone; 3. with the lower jaw; 4. with the *scapula*; 5. with the *sternum*; 6. with the tongue.

Its *Use* is to support the tongue; it is also said to be destined for deglutition, and the articulation of the voice ⁽⁸²⁾.

SECTION II.

The Bones of the Trunk.

We have already divided the Trunk, which is the second part of the skeleton, to which all the bones placed between the head and the extremities are to be referred, into

The *Spine*,
The *Thorax*, and
The *Pelvis*.

We noticed also, at the same time, of how many bones each of these is composed, and shall now treat of them individually.

⁽⁸²⁾ At birth, the *Os Hyoides* has always three distinct points of ossification, its figure being the same as in adults. It has no point of ossification till after the eighth month (Nesbitt). Kerckringius, therefore, was much mistaken in averring that—"not even its cartilage is visible in foetus (*Osteog. Foet. C. II.*)."

THE FIRST ORDER.

Of the Spine.

THAT bony column, which extends from the condyles of the *os occipitis* to the *os sacrum*, is called the *Spine*.

The series of bones, which makes the spine, resembles a column anteriorly round, but unequal posteriorly, because of many eminences and cavities ⁽⁸³⁾. Internally, it is hollow. Laterally, it has many *foramina* penetrating into its internal cavity.

The Bones which compose the spine are in *Figure* very like one another. They differ in *Size* ⁽⁸⁴⁾; they are conjoined together by inter-articular cartilages, or by synchondrosis; and they are distinguished by the proper name of *Vertebrae* ⁽⁸⁵⁾.

The

⁽⁸³⁾ The Spine is not straight, but incurvated so as to resemble, in some manner, the italic letter *f*. It is hard to trace likenesses in Anatomy. Superiorly it is drawn backwards, by muscles, and formed into a curve for supporting the *oesophagus*, &c. In its middle, it is also bent backwards, to contain the heart and lungs. Afterwards it is bent forwards, to sustain the abdominal *viscera*; and it again goes backwards, to enlarge the *pelvis*. As *Monro* observed (*Ost.* p. 166.).

⁽⁸⁴⁾ They are smaller above, but more solid: and they are larger below, but less solid. So that the *os sacrum* is specifically the lightest of all the *vertebrae*: and it is the lightest of all the bones of a skeleton.

⁽⁸⁵⁾ The word *Vertebra* comes from the Latin *Verto*, to turn; because, as *Vossius* says, "*Vertebrarum beneficio*

The intire spine consists of twenty-four *vertebrae*, which are subdivided into *three orders*. The uppermost are called the *Vertebrae* of the Neck, the twelve following, *Vertebrae* of the Back, and the five lowermost, *Vertebrae* of the Loins. Some authors refer hither the nine *vertebrae*, constituting the *os sacrum* and *os coccygis*, calling them, for the sake of distinction, *False* or *Spurious Vertebrae*; but we refer these to the *Pelvis*, and shall consider them whilst we treat of it.

Each *vertebra* is divided into

1. Its *Superior* and *Inferior Surface*,
2. Its *Superior* and *Inferior Margin*,
3. Its *Body* and *Seven Processes* or *Apophyses*.

The *Body* of each *vertebra*, which is the foremost and thickest part, has circumference anteriorly, more or less round, and a great notch, posteriorly.

The upper and under surface is alike covered with cartilage, composed of layers, and seemingly participating of a ligamentous nature ⁽⁸⁶⁾.

The

ficio homo se vertere, flectereque possit (See *Verto* in his *Etymolog. Ling. Lat.*).

⁽⁸⁶⁾ This is precisely what the intervertebral substance seems to be, for it has no affinity with cartilage in other parts of the body. It consists of concentric circles, which are more solid and elastic as they are nearer the circumference. The circles are nearer one another as they approach nearer the center of the surface of the body of the *vertebra*; and in the center, and for some space around it, they seem to be dissolved into a fluid, not much unlike *synovia*. Do this liquor answer the purpose of a pivot, in the various motions and concussions of the spine, as some physiologists have imagined?

The

The Seven Processes are,

1. *Two Superior, obliquely ascending*; one of which is situated superiorly, on each side.
2. *Two Inferior, obliquely descending*; of which one is placed inferiorly, on each side, all being equally covered with cartilage ⁽⁸⁷⁾.
3. *Two Transverse Processes*; one on each side of the angle; and
4. The *Spinous Process*, extending posteriorly, and ending in an epiphysis. These

The Intervertebral Substance is thickest in the loins, and thicker between the inferior than the superior dorsal *vertebræ*.

Mr. Wasse observed long since that the same individual is higher, from four to five lines, in the morning than in the evening (*Philos. Transf.* No. 383.), and this has lately been confirmed in France (*Sabatier De l'Ost. p. 101. Tom. I.*).—This may easily be accounted for, from the pressure and consequent absorption in the day; and from the removal of pressure, the expansion of the intervertebral substance, and the greater accumulation of fluids in the night.

Some say we become taller after eating plentifully, and shorter after fasting. This the Abbe Fontenu thinks to depend in part, if not wholly, on the various thickness of the intervertebral substance (*Hist. de l'Acad. des Scien. 1725.*).

Bernard Gengha is said by Sabatier (*De l'Ost. p. 101.*) to have long ago assigned the crookedness of the spine in old people, to the exsiccation and diminution of the intervertebral substance.

⁽⁸⁷⁾ Sabatier has properly enough observed (*Ibid. p. 99.*), that these, and the former, ought rather to be called *articular* processes or apophyses, than *oblique*, as they are termed by Leber and most Anatomists; because they serve particularly for the articulation of the true *vertebræ*. *Monro* called them *Oblique* (*Osteol. p. 170.*).
last

last processes, taken collectively, constitute the *Spine*, properly so called.

The *Foramina* and *Cavities* are

1. The *Great Foramen*, which concurs to form the great canal, continued through the whole spine, in which the spinal marrow is contained. This canal is larger in the neck and loins than in the back.

2. *Four Notches* so placed, that on each side, one is superior, and another inferior. The latter unite with the superior, or with the inferior of the contiguous *vertebrae*, and thus form the *Lateral Foramina of the Vertebrae*, through which the dorsal nerves pass. These *foramina* are larger in the neck and in the loins; but in the back they are smaller, and situated more posteriorly.

The *Substance* of the bodies of the *vertebrae* is spongy, and pervious from numerous *foramina*; that of the processes is compact.

The *Connection* of the Spine with the head is by ginglymus; with the *os sacrum* by synchondrosis. The *Vertebrae* are joined to one another, with their oblique processes, by diarthrosis; their bodies are conjoined by synchondrosis. Moreover, the dorsal *vertebrae* are united to the ribs.

The *Use of the Spine*, is to retain the body erect, and yet to leave a necessarily free motion; to support the head and trunk; to contain and preserve the spinal marrow; and to supply a passage, by its lateral *foramina*, for the nerves of the spinal marrow.

Of

Of the Vertebrae considered particularly.

The *Vertebrae of the Neck* are the seven first and uppermost of the spine ⁽⁸⁸⁾. They differ from all the rest.

1. Their *bodies*, especially forwards, are smaller and flatter.

2. The *superior surfaces* of the five inferior cervical *vertebrae* are hollowed transversely, from one side to another, but the *inferior surfaces* from behind forwards.

3. The *cartilages* interposed between these, are thicker than those between the dorsal *vertebrae*.

4. The *spinous processes* of the two first *vertebrae* are almost straight, but those of the others are successively inflected downwards, from the third. Their points are forked, and they are shorter than the spinous processes of the other *vertebrae*.

5. Their *Oblique Processes* are generally more oblique than those of the other *vertebrae*; and they are so covered with cartilage, that the inferior oblique processes of a superior cervical *vertebra* have always a superficial cavity for the reception of the superior oblique process of an inferior cervical *vertebra*.

(88) Some authors assert, that in long necks there are sometimes eight *vertebrae* (*Verheyen Anat. C. H. p. 444.*): and others say that, in people who have short necks, and are hence accounted predisposed to Apoplexy, there are oftentimes only six *vertebrae* (*Cullen's Lectures, M. SS.*)

It is probable that the bodies of the cervical *vertebrae* are flattened anteriorly by the *pharynx* and *oesophagus*.

6. The *Transverse Processes*, the first and last only excepted, are the shortest; their origin is double, but they end in an acute point. Besides, they have a particular *foramen*, which is a passage for the vertebral arteries and veins.

Independent of these more general observations, we must add the following particulars concerning the first, the second, and the seventh *vertebra* of the neck: viz.

The *First Vertebra* is called *Atlas*, because it sustains the head. This *vertebra* has no spinous process, which would prevent bending the neck backwards, but its place is supplied by a small eminence. The great *foramen* of this is much larger than that of any other *vertebra*. Its body, which is small and thin, is nevertheless firm and hard. It is somewhat like a ring, distinguished into its *Great Anterior Arch*, which serves in the place of a body, and its *Small Posterior Arch*.

On the *Anterior Arch* externally, is placed an eminence, and internally, a depression invested with cartilage, which receives the *dentiform* or *odontoid* process of the second *vertebra*. There is an eminence and a cavity on both sides, to the former of which the transverse ligament is affixed, to keep the dentiform process in its proper place.

The *Transverse Processes* arise by a broader beginning from the middle of the sides, are much longer than those of the six inferior *vertebrae*, and end in a more obtuse point.

point. Their *foramina* are in a perpendicular direction, and they have many depressions from the various muscles affixed to them.

Superior Oblique Processes it has not. But instead of them, there are two cavities lined with cartilage, which receive and unite, by ginglymus, with the articular condyles of the *os occipitis*. The inferior processes are placed under and opposite the superior, their cavities having a similar relation to one another, though smaller and connected with the superior oblique processes of the second cervical *vertebra*. Under the superior oblique processes there is a furrow, through which the arteries and veins of the head pass.

This *Vertebra* is joined superiorly to the head, by ginglymus; and inferiorly to the second cervical *vertebra*, by means of the inferior oblique processes and the dentiform process, by lateral ginglymus.

The *Second Vertebra* of the Neck is called *Axis* or *Epistropheus*. It has a body which exceeds in thickness and strength the other cervical *vertebrae*. Its *Transverse Processes* are very short, oblique, and perforated. Its *Spinous Process* is broad, deeply bifurcated, and divided above by an acute eminence into two lateral parts, and below by a line into two cavities. The *Dentiform Process* is on the superior surface of the body of this *vertebra* covered with cartilage, entering into a cavity of the first cervical *vertebra*, and joining to it by the transverse ligament,

and to the great occipital *foramen*, by two other ligaments, fixed laterally.

The *Body of the seventh of the cervical vertebrae* is broader than all the rest. Its *Inferior Surface* is almost flat. Its *Spinous Process*, which is almost straight, and the longest of all, is seldom forked. Sometimes there is a *foramen* in the *Transverse Processes*, which is the passage of the posterior cervical artery ⁽⁸⁹⁾.

Of the Vertebrae of the Back.

Next to the cervical are placed the *Twelve Dorsal Vertebrae*. These increase in size as

(89) Except the first cervical *vertebra*, which consists of two bones only, at birth, and the second and last, which consist of more than two, all the *vertebrae* are composed of three distinct parts, connected together by cartilage.

The anterior part of the first *vertebra* is entirely cartilaginous, and its two lateral parts are united by cartilage.

The second *vertebra*, called *Dentata*, because its dentiform process, is at birth always composed of as many as four parts, and oftentimes of five or six. One is the body, on which stands the tooth-like process, separated only by cartilage. Two lateral parts connected at their posterior ends by cartilage. On each side of the body, at the root of the transverse processes anteriorly, there is likewise a point of ossification, but this is frequently on one side only.

The last cervical *vertebra*, as above observed, has more than two parts at birth. It has a little bone on the anterior side of its transverse process (Nesbitt's Hum. Ost. p. 102.).

The spinous process is wanted in all the *vertebrae*, at birth (Kirkring. *Ost. Fæt.*), but its place is supplied by cartilage.

they

they are lower. Their *Bodies* are thick and broad, and their *Superior* and *Inferior Surfaces* are flatter, and more excavated backwards than those of the neck. On each *side* of the bodies, near the transverse processes, in the superior and inferior margins, there is a *Concavity* lined with cartilage; the two inferior concavities together with the two superior of the subsequent *vertebra* forming a *Notch*, to which the greater posterior extremity of the ribs is attached, hence each rib is always received between the bodies of two *vertebrae*.

The *Transverse Processes* extend rather backwards, and are less when they occupy a lower place. In the extremities there are *Articular Cavities* lined with cartilage for the reception of the smaller posterior extremities of the ribs. But these cavities are oftener wanting in the two last *vertebrae* of the back.

The *Oblique Processes* have a direction nearly perpendicular. The cartilaginous surface of the superior oblique processes extends forwards and is a little more broad, but the surface of the inferior is somewhat hollowed, and extended backwards.

The *Spinous Processes* of the four superior dorsal *vertebrae* are not so long, but they are broader and straighter than of the following. On the contrary, the spinous processes of the inferior *vertebrae* of the back, are sharp above, and thick below, and thin laterally; they tend more obliquely downwards, and

are placed closely over one another. The *Spinous Processes* of the eleventh and twelfth dorsal *vertebrae* are broad again, but they are short (9°).

Of the Vertebrae of the Loins.

The *Five Lumbar Vertebrae*, which are placed immediately after the Dorsal, are the last and the largest of the true *vertebrae*.

Their *Bodies* are larger, thicker, and broader than the bodies of all the rest.

Their *Surfaces* are smooth, but hollow in the middle.

Their *Spinous Processes* are laterally broad, but superiorly sharp, and divided inferiorly by a prominent *line* into two *labia*. They are erect, having a thick extremity.

Their *Transverse Processes* are smaller and longer than those of the lumbar *vertebrae*, the first and last only excepted, of which they are commonly shorter. The direction of these is strait, they are flat posteriorly, and smooth anteriorly.

Their *Oblique Processes* are all oblong. The superior are concave, the inferior are convex; they have *concave surfaces* covered with cartilage turned inwards, and *convex surfaces* turned outwards.

The *Inter-articular Cartilages* are thicker between these than between the other *vertebrae*.

(9°) There is nothing very particular in the dorsal *vertebrae* at birth. The parts where the ribs are articulated are cartilaginous.

The

The *Large Foramina* in the middle of the bodies of these *vertebrae* are larger than those in others; they are smooth before, and almost angular behind (⁹¹).

Of the Bones of the Thorax.

The *Thorax* or *Breast* is another part of the trunk, which resembles an arched bony cavity. It is narrow above, broad below (⁹²), flat anteriorly, hollow posteriorly, in the direction of the cavity, and convex laterally (⁹³).

(⁹¹) These *vertebrae* also consist of three parts, and, like the dorsal, differ but little from those of adults.

The last *Lumbar Vertebra* has a round protuberance anteriorly, which is partly formed by the superior part of the *os sacrum*, called the *Promontary of the os sacrum* (See note 102.).

(⁹²) It is observed particularly by Albinus, that the very bottom of the cavity of the *thorax* is more narrow and contracted than it is some way above (*De Offibus*, § 169.); and that the inflection of the bodies of the *vertebrae* forwards lessens this cavity posteriorly.

(⁹³) The Figure of the Breast is various. In some it is large and elevated, in others, it is small and flattened. Compression, especially during Infancy, may alter the natural Form of the Breast many ways: thus Stays, tightly laced, alter the figure of the breasts of women, and change the position of the thoracic *Viscera*; often impeding their functions, and sometimes occasioning the disease called a Consumption. Professor Sommering, of Mentz, has written an excellent Essay on the many Injuries done by confining the Bodies of Children in any manner, and on the inconveniences of Stays to pregnant women. The Book is published at Leipzig.—Professor Witte, of Rostock, has also published an Essay, worthy of attention, in Answer to this Question, *Is a national Dress advantageous, or detrimental?* This was published at Copenhagen.

The Thorax is composed of thirty-seven bones: viz.

The *Twelve Dorsal Vertebrae* posteriorly.

The *Sternum* and the *Ensiiform Cartilage* joined to it anteriorly.

The *Twenty-four ribs* laterally.

The *Dorsal Vertebrae* having been already described, we are next to treat

Of the Sternum.

The *Sternum* or *Breast-Bone*, which is placed longitudinally, between the cartilages of the true ribs, forms the anterior and middle part of the *thorax*.

Its *Substance* is spongy.

Its *Figure* is flat, unequally extended, and almost triangular. In adults, it consists of two parts, but in children it consists of more. The bounds of the parts composing it in children are marked by transverse lines in adults (94).

It is every where divided into the *Superior Part*, and into the *Inferior Part*, and its appendix.

(94) At birth the *sternum* is almost wholly cartilaginous, having more or fewer points of ossification. According to Doctor Nesbitt,—“scarcely two different *sternums* of the same age are ossified alike,” (Hum. Ost. p. 113.). Bartholin enumerated eight bones of the *sternum*, which he says, coalesce afterwards in adult persons into three, or four or more (*Anat. Reform. Lib. IV. Cap. XVIII.*). Kirkringius thought the number never to exceed six (*Ost. Foet. C. XV.*). In a word, what I have already quoted from Doctor Nesbitt’s Lectures is enough to reconcile these contrary opinions.

Into

Into its *Internal and External Surface,*

—— *Right and Left Margin,*

—— *Superior and Inferior Extremities.*

The *Superior Part* is the broadest and thickest; inferiorly it is smaller and thinner, resembling, in some manner, a triangle, or an irregular quadrangle.

The *Superior Extremity of this part* is thicker than the inferior, and has a *Notch* in the middle; the *Inferior Extremity* is narrow, thin, and connected to the inferior part of the *sternum*.

The *Inferior Part* is generally the narrower, but it is longer than the superior; the *Superior Extremity of this part* is the narrower, and adheres to the inferior extremity of the superior part; but the *Inferior Extremity*, which is broad, is connected with the ensiform cartilage ⁽⁹⁵⁾.

The *External Surface* of the *Sternum* is somewhat convex; the *Internal Surface* is concave.

The *Two Lateral Margins* are oblique and thick, having an *articular cavity* lined with cartilage, to receive the clavicle. Under this articular cavity, there are many *Notches* which receive the cartilages of the ribs.

(95) There is most commonly some motion between these two parts, but it is more remarkable in children. Sabatier saw a child labouring of the scrophulous *asthma*, in which the difficulty of breathing rendered the movement of the second part upon the first very manifestly upwards and downwards (*De l'Ost. p. 148.*).

The

The *Lowermost Part* or the *Appendix* of the *Sternum* takes its name from its likeness to a sword or dagger; and is accordingly called the *Ensiform Cartilage*, or *Process*, or the *Xyphoid*, or *Sharply pointed Cartilage*. The *Figure* of this cartilage is various; sometimes it is round, sometimes acute, and not unfrequently it is deeply bifurcated. In some it inclines inwards, in others it inclines outwards, and it is oftentimes perforated. Nor is its length less variable; in one it may be only the third part of an inch; in another, a whole inch; and, in a third, as it more frequently is, an inch and a half ⁽⁹⁶⁾.

The *Foramina* and *Cavities* of this Bone are,

1. A *Large Notch* in the superior extremity, to make room for the *aspera arteria*.

2. Two *Articular Cavities* of the lateral margins, receiving the clavicles.

3. *Seven Notches* or *Depressions* in the margin of each side, for the adhesion of the cartilages of the seven true ribs.

The *Sternum* is superiorly connected with the clavicle by arthrodia, and laterally with the seven ribs by synchondrosis.

(96) This appendix of the inferior part of the *sternum*, or third part, as some call it, retains the name of *Cartilage* even when it is completely ossified. *Monro*, after treating largely on the inconveniences which are induced by a male-conformation of this part, refers his students to the celebrated pathology of *Bonetus*, intitled *Sepulchretum Anatomicum*, Tom. II. Lib. 3. Sect. 5. Append. ad Obs. 8. et Ibid. Sect. 7. Obs. 19 (*Osteol.* p. 231.).

The

The *Use of the Sternum* is to support the ribs, anteriorly to defend the heart and lungs; and to be a place of attachment for the *mediastinum*, the diaphragm, and some muscles.

Of the Ribs.

The *Ribs* constitute the lateral parts of the *thorax*; they are bent like arches, and pass obliquely and almost transversely forwards and downwards, from the *vertebrae* to the *sternum*; to which they cohere in such a manner, that the extremities of the right and left ribs are always opposite each other.

The *Figure* of the ribs is semicircular.

There are twenty-four ribs naturally, twelve on each side ⁽⁹⁷⁾.

They are generally divided into *True* and *False* or *Spurious* Ribs.

(97) *Monro* has said that eleven or thirteen have been frequently found on one side; and, that he had a skeleton, in which the fourth and fifth ribs of the left side were grown together for near an inch at their root, but dividing afterwards, became as the ribs of the opposite side, which are naturally formed (*Osteol.* p. 216.).

Columbus (*De Re Anat.*) and *Diemerbroeck* (*Anat. C. H.*) only saw one instance in which there were eleven ribs on each side. *Bartholin* saw eleven on one side, and twelve on the other (*Cent. 5. Obs. 1.*). *Fallopious*, and others have, more than once, seen thirteen ribs on each side (*Obs. Anat.*).

Bartholin quotes one example in which the ribs were grown together, from the shoulders to the false ribs; and another, in which three were inseparably united (*Anat. Reform.*).

The

The seven uppermost ribs on each side are called *True* ; they are annexed to the *sternum* anteriorly by means of their cartilages, and are connected with the ribs of the opposite side, making so many entire circles.

The five ribs which are placed below the former, on each side, and which do not reach as far as the *sternum*, but are connected by their cartilages to one another, are called *Short* or *Spurious*. The two last of these are altogether unattached. The false ribs, therefore, do not unite and form entire circles, like the true ribs.

We may observe in each rib

Its *Body* or Middle Part,

Its *Anterior* and *Posterior Extremities*,

Its *Superior* and *Inferior Margins*,

Its *External* and *Internal Surfaces*.

The *Body* of the first rib is short, but broader than the bodies of the following. Its *Surfaces* are turned upwards and downwards, but its *Margins* are turned inwards and outwards, so that this very rib has a *Superior* and an *Inferior Surface*, and an *Anterior* and a *Posterior Margin*. In the six inferior true ribs, the *Body* is narrower, and becomes longer as the ribs themselves descend. The *Surfaces* are turned a little forwards and backwards ; the *Margins* are turned upwards and downwards. The *Bodies of the False Ribs* also decrease in order, the last being the shortest.

The

The proportion of the ribs, if we respect their length, is such that the *True* ones continually encrease as they descend, but the *False ones* decrease. The same may likewise be said of the length of the cartilages. The Ribs are, all of them, at about the distance of a finger's breadth from one another, but they are nearer posteriorly.

All the *Anterior Extremities*, a circumstance already noticed, are more depressed than the posterior; there is a small depression likewise in them, in which the cartilages are implanted.

The *Cartilages* of the seven superior ribs extend from the ribs to the *sternum*, and are received into as many small *depressions* destined for the purpose. They differ one from another in length, breadth, flexibility, and curvature. The cartilage of the first rib is short, and harder and firmer than the cartilages of the rest. The other cartilages are more flexible. The three superior follow the same direction as the ribs to which they belong; but the three following are always more curved, forming an angle, from which they ascend to the *sternum*, and come nearer one to another. The cartilages of the false ribs do not reach the *sternum*, but the three first unite together and are united to the cartilage of the last true rib⁽⁹⁸⁾. The cartilages of the

(98) The cartilages of the ribs, as of other parts, are harder and more solid internally than externally. Vesalius observes, that their middle part frequently becomes

the fourth, and fifth true ribs are loose and unconnected, except with contiguous muscles and membranes.

All the *Posterior Extremities* are placed higher than the anterior, and are more or less remote from one another, in proportion to the various thickness of the *vertebrae*, to which they cohere.

The *Two Margins*, of which the *superior* is the thicker and rounder, and the *inferior* the *sharper*, have an *internal* and *external labium*. In the first and second true ribs, the superior margin is sharp and turned backwards; the inferior margin is rather round, and turned forwards.

The *Eminences of the Ribs* are,

1. The *Large Head*, which has a *small surface*, above and below, divided by an *eminent line*, covered with cartilage, entering into the articular cavities of the dorsal *vertebrae*. The head of the first rib, and of the two last has only one little surface overspread with cartilage: but the others have two.

2. The *Neck* which is narrow and small, receiving the large head.

3. The *Small Head*, which adheres to the anterior extremity of the neck. Its cartilagi-

comes bony, while their external part is cartilaginous (*Lib. I. Cap. 19.*); and Clopton Havers, treating of the cartilages of the thorax, remarks, that they seldom or never become ossified where their greatest motion takes place, that is, in their larger curvature (*Oss. Nov. Disf. V.*).

nous surface is convex, and united to the extremities of the transverse processes of the dorsal *vertebrae*. This less head is not present in the eleventh and twelfth rib.

4. The *Angle of a Rib* is an oblique eminence, unequal, and more or less flat, adhering to the posterior extremity.

The *External Surface of the Ribs* is convex; but the *Internal Surface* is concave: in this latter there is a *Sulcus* towards its inferior margin, which goes forwards from the angle of each rib, and receives mostly blood-vessels and nerves.

This *Sulcus* is more remarkable in the inferior true ribs, and the superior spurious ones, than in others.

The *Substance of the Ribs* is compact externally, and internally spongy.

The *Posterior Connection of the Ribs* is double: for the large head is connected to the articular cavities of the *vertebrae*; and the less head to the transverse process of the *vertebra* next below it.

Anteriorly, the ribs are joined to the *sternum*, by their intermediate cartilaginous epiphyses. The three superior false ribs are connected together by means of cartilages, and also to the last true rib. The Motion of the Larger Heads is by ginglymus, and of the Less Heads by amphiarthrosis.

The *Use of the Ribs* is, to form the lateral parts of the *thorax*; to enlarge and to diminish the cavity of the *thorax* in respiration;
to

to defend the heart and lungs; to be a place of attachment for various muscles, and a support externally to the *mammæ* (99).

Of the Pelvis.

The *Pelvis*, which takes its name from its figure (¹⁰⁰), is placed at the bottom of the trunk.

It is *divided* into

1. Its *Two Wings* or Superior Lateral Parts, and

2. Its *Hollow*; of which we may notice the *Brim* and *Inferior Aperture* (¹⁰¹).

The

(99) The ribs, at birth, differ little from those of adults, in substance and form. They are rather more cartilaginous at their posterior articulation, and have less curvature: but their tubercles are bone, and their connection with the *sternum* and *vertebrae* of the back is similar to that in adults. Dr. Nesbitt says, the ribs at the fourth month are so nearly perfected, as not to differ in appearance from those at the ninth (p. 112.).

(¹⁰⁰) It is somewhat like a Barber's basin that has no bottom. Hence it is wrongly called a *Cavity* in Smellie's Treat. on the Theory and Practice of Midwifery, Vol. I. Sect. III. Roederer's *Elem. Artis Obstet. Cap. I. § 3.* and most other books on this subject. If it were a cavity, it should have a bottom. Meza proposes to call it a *Space* (*Tract. de Quibusd. Notab. ad Artem Obstet. spect.*). See Note 109. The figure of the *pelvis* is between that of an ellipsis and a triangle. The direction of the cavity of the *pelvis* is oblique.

(¹⁰¹) Wrisberg commends very highly the division of the *Pelvis* into three parts, viz. the *Brim* (*Introitus*); the *Cavity* (*Cavitas*); according to Meza *Spatium*. See Note 100), and the *Inferior Aperture* (*Exitus*). He says this distinction is absolutely necessary in communicating our ideas concerning the situation of the child's head; whether it be in the *superior* or *inferior* aperture of the

The *Pelvis* is composed of the eight bones below-mentioned (¹⁰²), viz.

The *Os Sacrum*, and *Os Coccygis*, posteriorly,

The *Ossa Ilei*, laterally,

The *Ossa Pubis*, anteriorly, and

The *Ossa Ischia*, inferiorly.

I.

The *Os Sacrum* is so named, it seems, because it was antiently sacrificed to the gods. It constitutes the posterior and inferior part of the trunk: it lies confined among the other bones of the *pelvis*, like a wedge, and may accordingly be considered as the base of the whole spine. It is for the same reason, that some anatomists have enumerated the *Os Sacrum*, and *Os Coccygis* with the *vertebrae*, calling them *Spurious Vertebrae*.

This great bone is like an oblong triangle, the base of which is placed upwards, and the apex downwards and inwards. In adults, it

the *pelvis*: that being the most dangerous period of parturition, in which the head of the child ought to pass through the inferior aperture (*Annot. in Elem. Art. Obs. Roedereri*, § 3.).

(¹⁰²) Ought not the last *vertebra* of the loins to have been enumerated among the bones of the *Pelvis* (See Note 91)? Its advantage in child-bearing and in labour seems to intitle it to that distinction. It retains the *uterus* in its proper place; obviates its ascension; and directs it to the margin of the *pelvis*.

is a single bone ; but in children it may be divided into five or six parts : which parts, as before observed, are distinguished by some Anatomists under the name of *Falsæ* or *Spurious Vertebrae* ⁽¹⁰³⁾.

We may observe in the *os sacrum*,

1. Its *Base*, which is raised upwards,
2. Its *Apex*, which is directed downwards, receiving the *os coccygis*,
3. Its *Anterior* or *Interior Surface*, which is hollow ; and its *Posterior* or *Exterior Surface*, which is convex,

⁽¹⁰³⁾ Albinus, who has written a whole chapter on this bone (*An. Acad. Lib. IV. Cap. XI.*), says, that he had an *os sacrum* which consists of six parts, altogether like that consisting of only five parts ; except in its supernumerary part, and the consequently greater length. He has also described other specimens of the same kind. Vesalius, as Albinus remarks, had noticed the same thing (*Vesal. de H. C. Fabrica, Lib. I. Chap. 18.*) : and Albertus relates that he found an *os sacrum* formed of seven parts (*Hist. Pler. Part. C. H. p. 112.*) : but it is clear the first bone of the *os coccygis* was grown to an *os sacrum*, composed of six parts ; as appears in the figure.

Various Hebrew writers, according to Caspar Bauhin (*Theat. Anat. Lib. I. Cap. 48.*) have dreamt that between the last *vertebra* of the loins, and the *os sacrum*, there is a bone of so singular a nature as to be destructible by no mechanical violence ; neither by fire, nor by any other power whatsoever, but that it will remain the same to the day of judgment, when the entire man is to be regenerated from it. This bone they called LUS, or LUZ. It was the phantasm of one Rabbi Ufchagi, who lived *An. Dom.* 210. and wrote a book, the title of which is *Bereſchit Rabba, i. e. Glossa Magna in Pentateuchum*. See also, concerning this bone, Agrippa de *Philos. Occulta. Cap. 10.*

The Moderns make no mention of this bone.

4. Its *Two Lateral Margins*, incrusted with cartilage, by the intervention of which it is connected to the *ossa ilii*. Moreover, it has many eminences, *cavities* and *foramina*.

Its *Foramina* and *Cavities* are :

1. The *Ten Foramina*, which run in a double order on the anterior surface of the bone, formed of the united notches of two *vertebrae*. The superior of these *foramina* are large, but as they descend they become less. Through these *foramina* a corresponding number of pairs of sacral nerves pass.

2. The *Ten Foramina* running in a double order on the posterior surface of this bone ; they are covered with muscles, and are the passages of small nerves and vessels.

3. The *Foramen* or *Canal* in the middle, like that in the middle of the *vertebrae*. The *Cauda Equina* is contained in this.

The *Lateral Margins* are broad and unequal above. It becomes us to notice the large cartilaginous surface, by the intervention of which the *os sacrum* is joined to the *ossa ilii*.

The *Eminences* of the *os sacrum* are

1. Two *True Oblique Apophyses* superiorly in its base, connected with the last *vertebra* of the loins.

2. *Eminences* posteriorly supplying the place of oblique, transverse, and spinous processes.

3. *Vestiges*, marking the distinct bones in children, on the anterior surface.

The *Substance* of the *os sacrum* is spongy.

It is *connected* superiorly, with the last *vertebra* of the loins; inferiorly, with the *os coccygis*; and laterally, with the *ossa innominata* by means of cartilages and ligaments.

Its *Use* consists in being the base of the whole trunk; and the posterior part of the *pelvis*: it receives the *cauda equina*, and has various muscles annexed to it ⁽¹⁰⁴⁾.

II.

The *Os Coccygis*, which is small and like an inverted pyramid, adheres to the base or inferior part of the *os sacrum*.

In infants the *os coccygis* consists of three or four parts; but these coalesce into one by age; leaving vestiges of their original separate condition ⁽¹⁰⁵⁾.

One

⁽¹⁰⁴⁾ The *os sacrum* in man is longer, but smaller and less curved than in woman. The reason of which is evident. It is to enlarge the capacity of the *pelvis*.

⁽¹⁰⁵⁾ At birth this bone is seldom more than four distinct cartilages: but Dr. Nesbitt once or twice saw a small ossification at that time in the two superior (Hum. Off. p. 107.). Paaw (*De Offib. P. II. Cap. 3.*) and Spigelius (*De H. C. Fab.*) consider the flexible state of this bone in children as the cause that they are oftener subjects of *Prolapsus Ani* than old persons.

Most practitioners in Midwifery assign a great part of the inconvenience of child-bearing in women, who do not become mothers till they are old, to the bony connection of the *os coccygis*: for in the natural state, the *os coccygis* is pressed backwards, and the inferior aperture of the *pelvis* is made larger by the passage of the child's head through it. Again, from its elasticity and pressure against

One may notice in the *os coccygis*,

1. An *Anterior* or *Internal Surface*, which is concave,
2. A *Posterior* or *External Surface*, which is convex,
3. A *Basis*, united to the apex of the *os sacrum*,
4. An *Apex* or *Inferior Extremity*, inflected somewhat forwards, but free.

It is connected with the *os sacrum* by syn-

against the child's head, it prevents the injury which might otherwise be done to the *perinaeum*. Paaw assures us of the inconvenience, which himself had experienced from this bone not receding backwards during delivery (*De Offib.*). Deventer thought an attention to this of so great moment, that he boasted the peculiar management of this bone amongst his greatest discoveries in midwifery (*Operat. Chir. Cap. 27.*).

It is an opinion amongst many, that birth is accelerated and facilitated, by pressing the *os coccygis* backwards with the fingers; but it becomes such assistants of Nature's operations, first, to learn the use of the *os coccygis*, which is to direct the head of the child under the arch of the *pubis*, lest it press against the *perinaeum*; and secondly, to know that if these bones be forced from their proper place, they may easily become immoveable.

Notwithstanding the consequences of a dislocation of the *os coccygis*, (which are inflammation and abscess,) a disease which is to be cured by introducing the finger into the *rectum*, it is certain, from the examination of living subjects, and those recently dead, that the *os coccygis* may easily be pressed backwards, at least an inch, in women that have borne children.

Beside the ordinary action of the *coccygei* muscles, as Roederer justly observes (*Elem. Art. Obstet. § 30. 7.*) suggests a reason, that the *os coccygis* should be moveable.

The *os coccygis* in women does not project so far forwards as in men (See Note 104.) on the *os sacrum.*).

chondrosis, arthrodia, and diarthrosis: and to the *Ossa Ischii* by syndesmosis.

It constitutes a part of the *pelvis*, and supports the *intestinum rectum*, which lies upon it.

III.

The *Ossa Ilii* form the superior and lateral parts of the *pelvis*.

Their *Figure* is irregular.

We may observe in each bone,

The *Internal Surface*, which is concave, and covered with muscles, like the external: it is unequal posteriorly, and in part covered with the cartilage which is united to the lateral part of the *os sacrum*.

The *External Surface*, which is unequally convex anteriorly, and somewhat excavated.

The *Superior Margin*, or *Crista Ilei*, which arises from the *Posterior Iliac Spine*, and runs as far as the *Superior* and *Anterior Iliac Spine*. This margin, in the recent bone, is like an arch covered with cartilage, and divided into an external and an internal *labium*. The extremities of this *crista* are called the *Spinous Processes* of the *Os Ilei*.

The *Lowermost Part* or *Base* of the *Os Ilei* constitutes a great part of the *Acetabulum* ^(106*), which is destined for the reception of the *os*

(106*) *Monro* says, that this bone reaches about as far downwards as a transverse section of one third of the *acetabulum*.

femoris, and the formation of the greatest part of the *Iscbiatic Notch*.

The *Eminences of the os ilei* are

1. The *Posterior Iliac Spine*, which is situated posteriorly at the beginning of the superior margin, where the *os ilei* is joined to the *os sacrum*.

2. The *Anterior and Superior Iliac Spine*, which is situated anteriorly at the end of the superior margin of the *os ilei*.

3. The *Inferior and Anterior Iliac Spine*, which is immediately under the former.

4. The *Oblique Iliac Spine*, which separates the *os ilei* from the *os pubis*.

5. The *Transverse Line*, which runs transversely backwards, from the oblique spine to the *os sacrum*; separating the internal surface of the *os ilei* from the *os ischii* and *os pubis*.

The *Cavities and Foramina* are

1. The *External Iliac Cavity*, and

2. The *Internal Iliac Cavity*, the former being in the external surface of this bone, the latter in the internal surface.

3. The *Notch* between the anterior iliac spines.

The *Fabric* of these bones is composed of two thin bony *laminae*, between which there is a spongy substance. The posterior and inferior part of these bones is the thickest, and the middle part is the thinnest and most compact.

In Infants, the *crista* of the *os ilei* is cartilaginous, and is joined to the bone under

the form of an epiphysis. The great inferior extremity is not perfectly bony in infants.

The *Os Ilei* is connected with the *os sacrum* by synchondrosis, and with the *os ischii* and *os pubis* by synostosis (¹⁰⁶).

IV.

The *Ossa Ischii*, *Ossa Coxae* or *Coxendicis*, constitute the lowermost lateral parts of the *pelvis*.

Their *Figure* is irregular.

One may observe in these bones,

1. The *Body*, which forms the lowermost and greatest part of the *acetabulum*.

2. The *Tuberosity* of the *os ischii*, which is that part of its inferior margin upon which we rest in sitting (¹⁰⁷). It has various depressions for the insertion of muscles.

3. The *Spine*, in the posterior and superior part of this bone.

4. The *Small Crus*, connected with the *os pubis*, and concurring to form the *foramen ovale*.

(¹⁰⁶) This bone is thicker in proportion to its magnitude at birth; and it is more spongy than in adults. See Note 107).

(¹⁰⁷) As these tubercles sustain the weight of our body when we sit, it follows that in women who are generally addicted to a sedentary life, they should be both larger and flatter than in men. The truth of this is proved by observation.

5. The

5. The *Foramen Ovale*, which is a large aperture formed by the union of the *os ischii* and *os pubis*. In its superior margin, it has an oblique notch, for the passage of the short ischiatic nerve and blood-vessels. The two *Obturatores Muscles* completely cover this aperture (¹⁰⁸).

6. The *Three Notches*; of which the *Posterior* is between the spine and protuberance of the *os ischii*, for the passage of the *obturatores interni* muscles; the *Lateral* is between the protuberance and the *acetabulum*, serving for the passage of the *obturatores externi* muscles; and the *Anterior* is at the margin of the *acetabulum*, serving for ligaments.

The *Ossa Ischii* are joined by suture to the *ossa ilei* and *pubis*.

These bones do not differ in substance from other flat bones. Their superior and posterior part is broad and thick; their inferior and anterior part is more narrow and thin.

In children, immediately after birth, that part of these bones which helps to form the

(¹⁰⁸) The use of this *foramen* seems to consist in its diminishing the quantity of bony matter, and lessening the weight, which the *pelvis* must otherwise necessarily have.

There is a disease of this part, first described by Garregeot (*Tome Premier 4to. de ceux de l'Acad. de Chirurgie, à Paris*) called the *Hernia of the Foramen Ovale*; in which, a portion of the *omentum* and intestinal canal is protruded from the cavity of the abdomen. This *Hernia* is situated in the superior and internal part of the thigh, near the *scrotum* of man, and the *labia pudendi* of woman.

acetabulum,

acetabulum, and the spine, and the protuberance, are cartilaginous.

V.

The *Ossa Pubis* constitute the anterior part of the *pelvis*.

Their *Figure* is irregular.

We may observe in them,

1. The *Thicker* and *Largest part*, which concurs to form the *acetabulum*; in the anterior extremity of which, there is a small eminence called the *Spine* of the *os pubis*.

2. The *Small Crus* turned downwards, and joined to a similar one of the *os ischii*, concurring to form the *foramen ovale*.

3. The *Superior Margin*, and

4. The *Inferior Margin*, in which there is a notch forming a part of the *foramen ovale*.

5. The *Internal* or *Anterior Part*, which is united with the *os pubis* of the other side.

The *Ossa Pubis* are conjoined together by *synchondro-symphysis*, and to the *ossa ilei* and *ischii* by future (¹⁰⁹).

These

(¹⁰⁹) The cartilage which connects the *ossa pubis* together is always thicker than that connecting the *os sacrum* with the *ossa ilium*. In both places, it becomes thicker in child bearing women, which oftentimes renders the connection so loose and unstable, as to give origin to pain, and crackling in walking. The cause of the enlargement of the cartilage at this time, seems to be the greater afflux of fluids. As to the separation of the *ossa ilei* from the *os sacrum*, and the *ossa pubis* from each

These three last bones, placed on each side, that is, the *os ilei*, *os ischii*, and *os pubis*, are com-

each other during parturition, which was noticed not only by Hippocrates, Avicenna, and other ancient physicians; but also by Riolan (*Anthropogr. Lib. VI. Cap. XII.*), Diemerbroeck (*Lib. XI. Cap. XVI.*), Hunter (*Med. Obs. and Inq. Vol. II. p. 331.*), and other late anatomists: there can scarcely be a doubt of its happening. Nevertheless, if we confide in Morgagni (*Advers. Anat. II. Animad. XV.*), this separation is not common. And, if it ever do take place, it will be hard to assign the cause.

That a separation of the bones of the *pelvis* may happen in robust and healthy people, from an external cause, is evident from the history of a peasant communicated to the Royal Academy of Surgery at Paris, by Mons. Philippe (*Mem. de l'Acad. Royale de Chir. Tome premier 4to.*).—This peasant in carrying a sack of corn, and suffering another to raise it from his shoulders, by some mishap, the sack fell upon his loins. As he seemed little injured by the accident, he followed his business, and felt little or no pain during the first two days. But on the third and fourth day, the pain was considerable, and he was bled several times, but died thirty days after the misfortune. When his body was dissected, the *os sacrum* was found separated from the *os ilium* three inches. Mons. Enaux likewise saw an instance of the *os innominatum* being luxated in consequence of a fall, in which surgery could not replace the bone. Nature cured the patient, though he remained somewhat lame (*Nov. Mem. de l'Acad. de Dijon. 1784.*). It has already been said, in what each bone of the *pelvis* of man and woman differs; it remains now, that the *pelvis* itself be spoken of, its difference from that of man, and the cause of the difference.

Statuaries had long since taken notice of the relative proportion of the distance between the trochanters of the *ossa femorum*, and the condyles of the *ossa brachialia*, in both sexes: they observe that, in woman, the distance between the former is greater than between the latter; but

comprehended by most Anatomists under the name of *Ossa Innominata*; and hence they divide

but that, in man, the contrary is true. All men agree that the beauty of the female frame consists in the larger size of the *pelvis*, and the uniform rotundity of the *nares*.

Wrisberg, however, advances further, and says, or seems to say, that if a woman have a small *pelvis*, like that of a man, and a flattened breast, such women having difficult labours, as these peculiarities detract from the wonted, native elegance of her shape, so likewise they are presumptive proofs that she is a virago (*Annot. in § 12. El. Art. Obst. Roed.*).

As the upper parts of the thighs are placed so far apart in women, this may be the cause that in preserving the center of gravity, they shuffle when they walk. The *Pelvis*, if well formed, is generally allowed to have a circumference equal to one fourth of the height of the female.

The diameter of the superior aperture of the female *pelvis*, if measured transversely from the middle part of one *os ilium* to the other, is commonly five inches and a quarter; if measured from the tubercle of the *os sacrum* to the *symphysis pubis*, it is only four inches and a quarter; and, if it be measured obliquely on each side, from the posterior angle of the *os sacrum* to the opposite part of the *ossa pubis*, which is the largest diameter, it is five inches and a half. But this last, *oblique diameter* as it is called, is often less than the first, or *transverse diameter*, which nevertheless is of little consequence, provided the second or *conjugate diameter* be of proper dimension. The transverse diameter of the inferior aperture of the *pelvis*, taken from the tuberosity of one *os ilium* to that of the other, is equal to the conjugate diameter of the superior aperture. The inferior conjugate diameter, which is measured from the apex of the *os sacrum* to the under part of the arch of the *pubis*, is equal to the transverse diameter of the superior aperture. We measure the conjugate diameter from the apex of the *os sacrum*, because it would be in-

determinate

divide the *pelvis* into the *os sacrum*, *os coccygis*, and two *ossa innominata*.

It is to be observed particularly of these bones, that they are joined together by synostosis to form the *acetabulum*, which is intended to receive the *os femoris*; therefore, that they are connected to the head of the *os femoris*, through the intervention of the *acetabulum* by enarthrosis.

This *Acetabulum* is placed inferiorly on the external surface, where these three bones coalesce. It is turned obliquely outwards. We may notice its *Margin* and *Notch*, the *Articular Cavity*, and the *Excavation* in the bottom of the cavity.

The *Margin* is very prominent, though it does not form an entire circumference around

determinate if measured from the *os coccygis*, which is moveable.

Now the direction of the superior aperture of the *pelvis* makes an angle of 55° with a horizontal line; and that of the inferior aperture, when the female is erect, inclines from a horizontal line at an angle of 18° .

The superior axis of the *pelvis*, which is a perpendicular line in the direction of the superior aperture, does not accord with the axis of the trunk, but forms an angle with it of 35° . The inferior axis inclines from the horizon at an angle of 72° .

The depth of the *pelvis* is, for the most part, anteriorly two inches, posteriorly five or six, and laterally four; which should particularly be remembered, as it is of great importance in the application of the forceps of Smellie, Levret, and others.

What relates to ill-formed *pelves*, as it is fully treated of in books on Midwifery, it may be wholly omitted in this.

the

the *acetabulum*; but is gradually depressed anteriorly and inferiorly, and is at length altogether interrupted by a *Notch*, through which vessels pass to the *acetabulum*. In the recent bones, this defect in the margin is supplied by a flexible, strong ligament. The cavity itself is invested with a very smooth cartilage, which in the recent bones is somewhat higher than the margin, making the cavity deeper. The cartilage now mentioned does not cover the whole *acetabulum*, but its anterior part only. Lastly comes the *Excavation*, which is unequal, is lined with cartilage, and receives the articular gland and round ligament.

The *Use* of all these bones is to form the *Pelvis*, and the *acetabulum* for the reception of the *os femoris*.

The *Use of the Pelvis* is to contain and secure a part of the *intestinum ileum*, the *intestinum rectum*, the urinary bladder, the *vesiculae seminales* and spermatic ducts in men, and the *vagina*, and adjoining parts in women.

Of the Bones of the Upper Extremities.

The *Arms*, or *Upper Extremities*, as was already observed, hang from both sides of the *thorax*, to which they are affixed, and extend even below the *pelvis*. Each of them is divided into four parts: viz.

1. The *Shoulder*,

2. The

2. The *Arm*,
3. The *Fore-arm*, and
4. The *Hand*: all which parts, collectively considered, consist of thirty-two bones, which we shall now severally describe. That which relates to the bones of one arm, relates equally to those of the other.

The Upper Extremities were given to us to perform our labour, and to defend our bodies.

Of the Bones of the Shoulder.

The *Shoulder*, which is the first part of the arm, is composed of two bones: viz. the *Scapula* and *Clavicula*. The *Top of the Shoulder* is the place where these two bones are connected.

Of the Scapula.

The *Shoulder Bone* or *Os Omoplatæ*, is placed superiorly and posteriorly in the back. It extends from the first to about the seventh rib.

Its *Figure* is almost triangular. It is a broad, smooth, and thin bone. It is bone even in foetus of five months old (¹¹⁰).

We

(¹¹⁰) The *Scapula*, at birth, has the bony rim of its *basis* more round than in adults. It is also surrounded by a large cartilage at its inferior angle, which is rounder than in adults. The surface of the *scapula* next to the ribs is not so hollow, but it is much smoother. Its spine is

We may observe in the *scapula*,

1. Its *Anterior* and *Posterior Surface*,
2. Its *Superior, Anterior, and Posterior Margin*,
3. Its *Three Angles*; the *superior*, which is external, the *inferior*, and the *Anterior* or *Superior Internal*.
4. Some *Eminences*, and
5. *Cavities*.

The *Posterior* or *External Surface* is raised unequally, and divided into two, by the *Spine of the Scapula*. The superior part is narrow, but the inferior is much broader; both parts are covered by muscles.

The *Anterior* or *Internal Surface* is unequally concave, and marked by many eminent lines, to which the incumbent muscle is attached.

The *Superior Margin* is the smallest and thinnest. It is situated between the neck of the *scapula* and the superior external angle.

The *Posterior* or *External Margin* is called by some the *Base of the Scapula*; it is the longest of all; it descends obliquely near the spine, so that it is at a greater distance from the *vertebrae* of the back inferiorly. It has an *Internal* and an *External Labium*.

is not so high. Its extremity which is connected with the *acromion* is neither so much curved nor so round.

The *Coracoid Process* is wholly cartilaginous.

The *Glenoid Cavity*, into which the head of the *humerus* is received, is more shallow, and narrower at its upper part (Nesbitt's Osteog.).

The

The *Anterior* or *Internal Margin* is the thickest. It descends obliquely backwards from the neck to the inferior angle. It is manifestly divided by a *furrow* into two *labia*, the *external* of which is thin, but the *internal* is thick and round.

The *Three Angles* of the *Scapula* are so placed, that the *superior*, which is called the *External*, is between the posterior and superior margin. The *other* is situated between the posterior and anterior margin, and is called the *Inferior Angle*. Finally, the *Anterior* or *Superior Internal Angle* is that which lies between the Superior and Inferior margin. It is the largest, and is called the *Neck of the Scapula*.

The *Eminences* of the *Scapula* are these : viz.

1. The *Spine of the Scapula*, which divides the posterior surface.

2. The *Coracoid Process*, or Process like the beak of a crow, as it is called from its figure : it arises from the anterior part of the superior margin, ascends from thence, and is inclined forwards, where it ends in an obtuse point. It is a place of attachment for various muscles.

3. The *Acromion* is a broad production of the spine of the *scapula*, flattened anteriorly for its connection with the clavicle, and covered with a cartilaginous surface.

Its Cavities are,

1. The *Glenoid Cavity*, which is situated at the extremity of the neck of the *scapula*,

VOL. I.

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is of a form almost oval, broad below, narrow above, and covered with cartilage. It receives the head of the *os brachiale*.

2. The *Small Depression* at the end of the *acromion*, in which the clavicle is fastened.

3. The *Supra-spinal*, and

4. The *Infra-spinal Cavity* in the posterior surface of the *scapula*.

5. The *Three Notches* in the superior part of the *scapula*, which from their various size, are distinguished into the *Small Notch*, situated between the superior margin and the coracoid process; the *Large Notch*, formed of the spine and neck of the *scapula*; and the *Middle Notch*, formed of the coracoid process and the glenoid cavity.

The *Substance* of the *scapula* is spongy, being covered externally by compact *lamellae*. Nevertheless, the spongy substance is of various thickness, for in the neck and coracoid process it is very thick, in the inferior margin and spine it is less thick, and it is thinnest in the body, which is consequently almost wholly transparent.

The *Connection* of this bone is, 1. with the *os brachiale* by arthrodia: 2. with the clavicle by synarthrosis: 3. with the head, the *Os Hyoides*, the *Sternum*, the *Ribs*, and the *Vertebrae* by syssarcosis.

Its *Use* is, to be joined to the *os brachiale*, to defend the posterior part of the trunk, to render the motion of the various muscles inserted

inserted into it more easy, and, lastly, to assist especially in carrying burthens.

Of the Clavicle.

The *Clavicle* is placed almost horizontally in the anterior part of the thorax, between the *acromion* and superior and lateral part of the *sternum*.

Its *Figure* is somewhat like the italic letter *f*.

It is perfected in foetus, and properly incurvated ⁽¹¹¹⁾.

It is divided, as all cylindrical bones are, into its *Body*, and its *Anterior* and *Posterior Extremity*.

The *Body*, together with the anterior extremity, forms an arch; hence this bone is convex externally, and concave internally. The body has two *Surfaces*, the *Superior* of which is the smoother, for the *Inferior* is marked with a *Superficial Furrow*, in which the subclavian vessels lie.

The *Anterior Extremity* is thicker than the posterior; it is almost triangular, and is united laterally to the uppermost cavity of the *sternum*.

The *Posterior Extremity* is smaller, flatter, and smoother than the preceding: it is unequal both above and below, from various

⁽¹¹¹⁾ This bone is so completely formed before three months after conception as to differ from that of adults only in magnitude.

eminences, and is inflected outwards so as to make a small arch. It has a smooth, roundish articular surface, covered with cartilage, and united to the *acromion*.

Its *Substance* is spongy, it is covered with compact *lamellae*.

It is connected by its anterior extremity with the *sternum*, and by its posterior extremity, superiorly and posteriorly, with the *acromion* by arthrodia ⁽¹¹²⁾.

Its *Use* is to render the superior extremities firm, lest they roll too far forwards over the *thorax*; to defend some of the larger vessels, and to unite the *scapula* and shoulder to the *thorax* ⁽¹¹³⁾.

Of the Os Brachiale ⁽¹¹⁴⁾.

The *Os Brachiale*, or *Os Humeri*, takes its name from its situation: it begins between the *acromion* and fore-arm at the breast, and is pendulous by its sides.

Its *Figure* is cylindrical.

It is *divided*, like other cylindrical bones, into *two extremities*, both which are epiphyses

⁽¹¹²⁾ Monro says, that "sometimes a moveable ligamentous cartilage is found in this joint; otherwhiles such a cartilage is only interposed at the anterior half of it, and in some old people I have found a sesamoid bone here." *Osteol.* p. 244.

⁽¹¹³⁾ This bone is less incurvated in women than in men (*Kulm Tab. Anat.* p. 60. 6.).

⁽¹¹⁴⁾ Celsus observes—" *Brachium constare ex cubiti osse et radii* (*Lib. VIII. Cap. I.*). " It may be useful to remember this in perusing the books of old Anatomists.

in children, and into the *middle part* or *body* ⁽¹¹⁵⁾.

In its *Superior Extremity* we may take notice of the following *eminences* and *cavities*: viz.

1. The *Head*, which is hemispherical, and covered with cartilage, its center being turned obliquely backwards, towards the articular cavity of the *scapula*, into which it is received.

2. The *Neck*, which is small and placed below the head.

3. The *Larger Tubercle*, pointing upwards, and seated opposite the head; it has two small surfaces, to which muscles are attached.

4. The *Smaller Tubercle*, which is seated more laterally, having also a small surface for the adhesion of muscles. Betwixt both these protuberances, there is a *Furrow* of considerable depth, which passes backwards and receives the long tendon of the *Biceps Muscle*.

At the *Inferior Extremity*, there are three *Articular Condyles*:

The *External Condyle* is unequally oblong, and very small. It is directly under the great protuberance of the superior extremity.

(115) The *Os Brachiale* is straiter in foetus than in adults. There is, at this time, no cavity for the reception of the coronoid epiphysis of the *ulna* in the flexion of the fore-arm, nor is there the small cavity for the head of the *radius* (Nesbitt's Osteog.).

The *Internal Condyle* is larger than the former and very protuberant.

Various muscles are affixed to these two condyles.

Between the internal and external condyle, there is the *Capitated Condyle*, which is covered with cartilage, and received by the superior extremity of the *radius*.

Between this and the external condyle, there is the *trochlea* or pulley of the *os humeri*, in the middle, in which the *os ulnae* is inserted.

Besides, there are three small *Depressions*, two of which are *Anterior* and one is *Posterior*.

The *Great Depression* is placed immediately over the internal *foveola* of the *trochlea*, receiving the coronary process of the cubit.

The *Small Depression* is placed externally over the capitated condyle.

The *Posterior Depression*, which is the largest, is placed immediately behind the broader *foveola* of the *trochlea*, that the *oleo-ranon* may enter it in extending the arm.

The *Body* is thick above, and rounded; inferiorly, it is smooth and small. There are three *Prominent Lines* in it; the *first* of which passes from the large tubercle, the *second* from the small tubercle to the inferior extremity, and the *third* extends as far as the external condyle of the inferior

ex-

extremity This bone is divided by these lines into so many *surfaces*.

The *Substance* of its body is compact, internally reticular, and filled with marrow. The substance of each extremity is spongy.

It is connected superiorly with the *scapula* by diarthrosis, with the *radius* by lateral and angular ginglymus, and with the *ulna* by angular ginglymus.

The *Use* of this bone is to concur to form the arm.

Of the Bones of the Fore Arm.

The *Fore Arm*, as already noticed, consists of two bones; the one placed internally towards the little-finger, called the *Ulna*, the other externally towards the thumb, called the *Radius*.

Of the Cubit.

The *Ulna* or *Cubit* is placed on the inside of the fore arm, from the *trochlea* of the *os humeri* towards the little finger. It is longer than the *Radius*.

The *Figure* of the *ulna* is unequal and triangular; it is thicker above, and becomes gradually smaller downwards.

It is divided into its *Body*, and its *Superior* and *Inferior Extremity*.

In its superior extremity, it has *two Processes*, the *Larger* of which is called *Olecranon* or *Processus Anconeus*. The *Smaller*, which is

more acute and more anterior, is called the *Coronary Process*; under this latter process there is a small *Eminence* to which the tendon of the *brachialis internus* muscle is attached.

Its *Cavities* are

1. The *Great Sigmoid Cavity* placed between the processes above mentioned, which is lined with cartilage, and divided into two by a *prominent line*, extending through the middle, from the coronary process to the tubercle. Both these parts are again conjoined by a *transverse furrow*. It is wholly destined for the insertion of the pulley of the *humerus*.

2. The *Small Sigmoid Cavity* placed on the outside of the coronary process, and covered with cartilage, like the former, for the rotation of the lateral part of the superior extremity of the *radius*.

The *Inferior Extremity* is more narrow, and less than the superior: we may notice in it,

1. The *Small Head*, which is somewhat hollowed anteriorly, and covered with cartilage on all sides.

2. The *Styloid Process* placed laterally towards the tubercle, and separated from the Small Head by a notch. This process, together with the small head, constitutes a kind of Ankle on the inferior and internal part of the fore arm.

The part below the small head, which is more narrow, is called the *Neck*.

The

The *Body* is divisible into three *Surfaces*, and as many *Angles*; the *first* of which is concave, and placed by the side of the smaller sigmoid cavity; the *second* is round and narrow, and situated under the tubercle; the *last* is flattened, and seated on the opposite side.

The *Exterior Angle* is sharp, descending from the smaller sigmoid cavity: the interosseal ligament adheres to this angle. The two *Internal Angles* are distinguished into the *Superior* and *Inferior*, both arising from the tubercle.

The *Substance* of the cubit, as of the *os humeri* and all cylindrical bones, is three-fold.

Its *Connection* above is made by angular ligament with the *trochlea* of the *humerus*, below with the wrist by arthrodia; and laterally, both above and below, with the *radius* by angular ligament.

Its *Use* is to concur in forming the fore arm, and in facilitating the flexion and extension, and the rotation both inwards and outwards (¹¹⁶).

Of the Radius.

The *Radius* lies on the outside of the fore arm, towards the thumb.

(¹¹⁶) At birth, it is curved more inwards than afterwards. Its body is nowhere triangular, as in adults. The *Olecranon* is cartilaginous, and so is the inferior head of the *ulna*.

Its

Its *Figure* is cylindrical, unequal and triangular.

The *Substance* and the *Division* of this bone is the same as that of the *Ulna*, except that the *radius* is somewhat shorter.

The *Little Head* or *Superior Extremity* of the *radius* is smaller than the inferior. It is excavated, and covered with cartilage, for the insertion of the capitated condyle of the *os humeri*. The margin next the *ulna* has a broader cartilage to be united to the sigmoid cavity of the *ulna*. Under the little head there is the *Neck*, which ends posteriorly in an uneven *Eminence*, to which the tendons of the *biceps* muscle adhere.

The *Inferior Extremity* of the *radius* is broad, and possessed of three *Surfaces* and as many *Angles*.

Two of the *Surfaces* are broad, the other is narrow. The one of the broad surfaces is situated under the flexion of the *humerus* backwards, it is smooth, but somewhat hollowed; the other broad surface is broader than the former, is placed under it, and inclined downwards. This latter surface is unequally convex, and divided by certain prominent *lines* into three or four *longitudinal furrows*, in which the tendons of muscles are inserted. The Narrow Surface is hollowed longitudinally, by means of its sigmoid notch covered with cartilage, it receives the inferior extremity of the *ulna*. Two of its *Angles* surround its narrow surface, so that they separate

parate all the three surfaces from one another. The *Third Angle* is situated betwixt both broad surfaces, and is inclined outwards in the position of the arm already mentioned; it terminates in an obtuse point, which is called the *Styloid Process of the Radius*. The Angle now mentioned and the obtuse point, both together, constitute a kind of Angle externally. The whole inferior extremity of the *radius* ends in a superficial oblong, triangular *Excavation*, which is covered with cartilage, and divided by a very small line, into two parts, which receive the two first bones of the *carpus*.

The *Body* of the *Radius*, which is turned somewhat outwards, has three *Surfaces*; *one* external, which is *round*, and *two* internal, which are *flat*. It has also three *Angles*, the *superior* and *inferior*, which are obtuse, separating the round surface from the two flat; the third angle, which is the *internal*, is acute, separating the surfaces already noticed from one another, and keeping the interosseal ligament firm. In these surfaces, there are various inequalities to which muscles are attached.

The *Radius* is connected above with the capitated head of the *os humeri* by angular and lateral ginglimus; below with the *ossa naviculare*, *semilunare*, and *cuneiforme* of the *carpus*, by arthrodia; and above and laterally with the *ulna* by lateral ginglimus.

Its

Its *Use* is to concur in forming the fore arm, and assisting the flexion of the hand inwards and outwards (¹¹⁷).

Of the Bones of the Hand.

The Bones of the *carpus*, *metacarpus*, and fingers compose the Hand.

Of the Carpus.

The *Carpus* is situated between the fore arm and *metacarpus*; it consists of eight small bones, the figure of which is irregular. These bones are divided into two classes.

The *Figure* of the *carpus* is quadrangular.

We should notice of the *carpus*, its two *Surfaces*, the *external*, which is convex, constituting the *back of the hand*; and the *internal*, which is concave, and possessed of four eminences, to which the internal transverse ligament of the wrist adheres:

Its *Four Margins*; the *Superior*, which is convex; the *Inferior*, which is connected with the *metacarpus*; the *External*, which is large, and turned towards the *radius* or thumb; and the *Internal*, which is small, and turned towards the *ulna* or little finger.

Each of the two classes is made up of four bones, of which those that are placed above

(¹¹⁷) Both extremities of the *radius* are epiphyses at birth; but about four months after conception, this bone and the *ulna* do not differ in any thing very remarkable from those at nine months,

are joined to the bones of the fore arm, but those that are below, are joined to the bones of the *metacarpus*.

In the *First Class*, from the *radius* towards the *ulna*, are comprehended the

1. *Os Naviculare* (¹¹⁸),

2. *Os*

(¹¹⁸) There are two methods of distinguishing the bones of the *carpus*; the one is by giving to each a peculiar name, the other is by giving to each a numerical denomination. Michael Lyserus, the *Anatomicus Adjuvens* of Bartholine's school, is said to have invented the former, and the greater number of Anatomists still retain and prefer his method. Heister, however, chose to distinguish them by numbers, thinking the imposition of peculiar names altogether needless (*Comp. Anat. Ed. Amstel.* 1748.). But Monro rightly says, that—"the method of ranging them by numbers leaves Anatomists too much at liberty to debate very idly, which ought to be preferred to the first number, &c." (*Osteol.* p. 260.).

As Lyserus is upon my table, the book being hard to be gotten by many, I will endeavour to oblige my curious reader by transcribing his words.—"*Impossibile enim est oratione eum (positum) manifestare, cum propriis nominibus ossa ista careant. Tentabo tamen an aliquali descriptione, quo ordine conjungenda sint, indicare possim, impositis nominibus à forma eorum depromptis. Pollici subjacet cubiformi simile, sed valde inaequalibus lateribus; trapezoides rectius dices: Indici trapezium: Medius profundamento habet os omnium in carpo maximum et crassissimum, in postica parte capitulum obtinens: Annulari et minimo substat os unciforme, quia interius in manu unci in modum est incurvatum, huic adjacet in latere externo aliud ossiculum, cujus latera quatuor triangula conficiunt, cuneiforme dici possit; cui iterum adhaeret minus adhuc ossiculum pisi sativi magnitudine, parte ea, quae priori objicitur, depressum. Sex illa ossa ordine resensito connectenda. Ideoque singula bis acu pertundes, ac filium sicuti per summa metacarpi capita traduces: non tamen in recta linea conjunguntur,*

2. *Os Semilunare*,
3. *Os Cuneiforme*, and
4. *Os Pisiforme*, or *Orbiculare*.

These bones now mentioned have, all of them, their proper articular *Surfaces*, which are covered by cartilage and connected with the contiguous bones.

The following belong to the second class: viz.

1. *Os Multangulum Majus*,
2. *Os Multangulum Minus*;
3. *Os Capitatum*, and
4. *Os Unciforme*.

The *Os Naviculare* has four *Surfaces*; the *Superior*, which is convex, and joined to the inferior extremity of the *radius*; and the *Inferior*, which is covered with a thick, but a small cartilage, the former of which is connected with the first bone of the second order, the latter with the second bone of the same order. The *Internal Surface* has two cavities, the great one, which receives the *os capitatum*, and the small one, which receives the *os semilunare*. It is this very bone which

guntur, sed oblique nonnihil et arcuatim: Bina adhuc supersunt ossa, quorum alterum κατωλοειδές appello, ob sinum, quo capitulum maximi ossis recipit: alterum lunatum nomino, quia sinum nactum est semilunarem, quo eidem capitulo occurrit (Culter Anatom. Lib. V. Cap. II.)."

Kerckringius says the cartilages which supply the place of the carpal bones, are often united together; but Nesbitt asserts that they are always generated distinct, and have the same articulations as at birth, when though totally cartilaginous, they are nevertheless of the same form as those of adults.

forms

forms one of the four protuberances of the *carpus*. The *External Surface* is unconnected.

The *Os Semilunare*, which is another bone of the first order, has also its four *Articular Surfaces*: viz.

The *Superior Surface*, which is round and convex, forming with the convex surface of the *os naviculare*, a small long protuberance, received by the inferior depression of the *radius*.

The *Inferior Surface* is concave, and with a similar surface of the *os naviculare*, receives the *os capitatum*.

The *Internal Surface* is nearly triangular to receive the *os cuneiforme*; and the *External* to receive the *os naviculare*.

The *Os Cuneiforme* is the third bone of the first order, having the four following *Articular Surfaces*. The *First* which is protuberant, makes the superior margin of the *carpus*, the *Second* is united with the *os unciforme*, the *Third* with the *os semilunare*, and the *Fourth* with the *os pisiforme*.

The *Os Pisiforme* is the fourth bone of the first series. It constitutes the second protuberance of the *carpus*. It has only one surface, which is cartilaginous, and conjoined to the *os cuneiforme*.

The other order of bones belonging to the wrist begins from the *os multangulum majus*, which forms the third protuberance of the *carpus*; and has a *fulcus* anteriorly, in which the tendon of the *flexor pollicis proprius* musculus is inserted.

This

This bone has four *Articular Surfaces*: viz. the *Superior*, which is concave, and connected with the *os naviculare*; the *Inferior*, which receives the first bone of the *metacarpus*; the *Internal*, which is turned upwards, to the second bone of the first order, and is connected inferiorly with the extremity of the second bone of the *metacarpus*. The External Surface of the *os multangulum majus* is free from attachment.

Os Multangulum minus is another bone of the second order of the *carpus*, in which we may notice the following cartilaginous *Surfaces*: viz. the *Superior*, that is small, and connected with the *os naviculare*: the *Inferior*, that is joined to the inferior extremity of the second metacarpal bone: the *External*, that is attached to the first bone of the second order of the *carpus*: and the *Internal*, that receives the third carpal bone of the second order.

Os Capitatum is the third bone of the second order of the *carpus*. It has a small, round *Head* superiorly, which is covered with cartilage, and enters the cavity formed by the two first carpal bones of the first order. It has a surface inferiorly, that is unequally triangular, connected with the third bone of the *metacarpus*. Its *External Surface*, which is the least of all, is united to the *os multangulum minus*; and its *Internal Surface* is attached to the surface of the *os unciforme*.

Os Unciforme is the fourth bone of the second order of the *carpus*.

Its

Its parts worthy of notice are, the *Head*, the *Process*, and the *Three Surfaces*. The *Process*, which is flat and curved, extends from the internal part of the body, and forms the fourth protuberance in the concavity of the *metacarpus*. The *Internal Surface* is united to the surface of the *os capitatum*. The *Superior Surface* is partly convex and partly concave, to be adapted to the inferior surface of the *os cuneiforme*. The *Inferior Surface* is subdivided, by a curved eminent line, into two less surfaces, which receive the two last metacarpal bones.

The *Internal Transverse Ligament* of the *carpus* adheres to the four protuberances of that part.

The *Connection* of these bones is made in the following manner; with the bones of the fore-arm by arthrodia; with one another, by synarthrosis; and with the bones of the *metacarpus* by angular ginglymus.

The *Use* of the bones of the *carpus* is to facilitate the motion of the hand, and to fit it for its various offices.

Of the Metacarpus.

Next to the *carpus* is the *Metacarpus*: which is composed of five small, cylindrical bones, placed between the *carpus* and fingers.

The *Figure* of the *Metacarpus* is quadrangular.

We may notice in the *Metacarpus*

VOL. I.

M

Two

Two Surfaces ; the *External*, which is convex, forming the back of the hand ; and the *Internal*, which is concave, forming the palm.

Four Margins ; of which the *Posterior* or *Superior* is turned towards the wrist, and the *Anterior* or *Inferior* towards the fingers. The *External Margin* is in the same line as the thumb, and the *Internal* in the same as the little finger.

The Bones of the *Metacarpus*, like other cylindrical bones, are divided into

The *Body*, and

The *Anterior* and *Posterior Extremity*.

The *Substance* of the metacarpal bones is also like that of other cylindrical bones.

All the extremities of the metacarpal bones that are turned towards the wrist, the first only excepted, are triangular, covered with cartilage, and having small cartilaginous *fasciculi* laterally.

The *Body* of these bones is narrow, and divided into three surfaces by three angles: the *External Surface* is convex, forming a part of the back of the hand, the other two turned inwards, are somewhat concave.

The anterior extremities, which are contiguous with the fingers, resemble a little head, laterally flat, and covered with cartilage. Immediately under this little head, each bone has two obtuse eminences.

The *First Bone of the Metacarpus* is by some authors accounted the first phalanx of the thumb ; and these authors refer only four bones

bones to the *metacarpus*; but as its resemblance to the other metacarpal bones is so great, it seems to us better to class it with them.

The *Posterior Extremity* of this bone has cavities and eminences, for the reception of the eminences and cavities of the multangular bone.

The *Anterior Extremity*, or *Head*, is smooth above, but like the other bones of the *metacarpus*, and joined with the first phalanx of the thumb. It is the shortest and thickest bone of the *metacarpus*.

The other bone of the *metacarpus*, which extends to the fore-finger, is the longest of all. Its superior or posterior extremity to the *os multangulum minus*; its inferior or anterior extremity is joined to the first phalanx of the fore-finger.

The *Third Bone of the Metacarpus* adheres to the *os capitatum* of the *carpus*, by its posterior extremity; and to the first phalanx of the middle-finger, by its anterior extremity.

The *Fourth Bone* is connected by its posterior extremity with the *os unciforme*, and with the ring-finger by its anterior extremity.

The *Fifth Bone* of the *Metacarpus* is the least of all, and shorter than the other three. Its posterior surface is not triangular, as of the rest, but is equally broad, and joined to the middle surface of the *os unciforme*. Its anterior extremity is connected with the first phalanx of the little-finger.

The first metacarpal bone is joined to the *os multangulum* of the *carpus*, by arthrodia; but the connection of the other bones of the *metacarpus* with the *carpus* is by angular ginglymus. Lastly, they are all conjoined by their anterior extremities to the fingers, by arthrodia (¹¹⁹).

Of the Fingers.

The *Fingers* constitute the last and anterior part of the hand. There are five fingers belonging to each hand, which differ from one another in size and length.

They are placed at the anterior extremities of the metacarpal bones.

They resemble in *Figure* an elongated pyramid, externally convex, and internally concave.

Each finger is composed of three bones; but the thumb consists of two bones only, which are distinguished into as many orders, or *Phalanges*. Again, the phalanges are of various magnitude, and are divided into the *First* or *Posterior*, the *Middle*, and the *Last* or *Anterior*.

The *Body* and two *Extremities* may be noticed of each of these, as of all other cylindrical bones.

(¹¹⁹) The metacarpal bones of children, at birth, are more smooth and straight than of adults. At birth too their epiphyses are cartilaginous. At four months after conception, they are so completely ossified as to differ from those of adults only in magnitude.

The

The *Thumb* has only two phalanges, for we have referred the first to the *metacarpus*. The *First Phalanx* is excavated posteriorly, covered with cartilage, and bounded on each side by small eminences; it is contiguous with the first bone of the *metacarpus*. Its *Body* is somewhat bent, so that its external surface is convex, and its internal surface concave. In the concave surface there are two unequal lines to which the transverse ligament adheres. The anterior extremity extending to the last or anterior phalanx, is formed like a pulley, is covered with cartilage, and possessed of a small depression on each side, and small eminences to receive the posterior extremity of the anterior phalanx.

The *Other Phalanx* is shorter than the former: its posterior extremity has a double cavity, covered with cartilage, where the eminences of the pulley of the first phalanx are inserted. The external surface of the body is smooth; its anterior extremity resembles the margin of a hemisphere, being altogether unequally semilunar.

The *Phalanges of the four other fingers* are very like one another, differing only in size. The phalanx of the fore finger scarcely differs in size from that of the little finger. The phalanges of the middle finger are the longest: those of the little finger are the smallest and shortest. There is a like proportion between the fingers themselves. In the phalanges of the first and second order, the surfaces both

convex and concave, are more manifestly distinguished than in the phalanges of the last order, in which the surfaces are very smooth. In the concave surface of the former, there is an uneven line, to which the transverse ligaments, serving to keep the muscles steady, are attached. This line, however, is not discernable in the last phalanges. The posterior extremities of the first order have a round concavity, into which are received the bones of the *metacarpus*. The anterior extremities resemble a pulley, and are joined with the phalanges of the second order: both extremities are covered with cartilage.

In the posterior extremity of the second order of phalanges, there is a double excavation, in which the pulley above-mentioned of the first order of phalanges is always inserted. Again, the anterior extremities of these are received by their *trochlea* into the excavations of the posterior extremities of the last phalanges.

The Last Phalanges of the Fingers, like the last phalanx of the thumb, have semilunar margins, in which the tendons of the muscles which move the fingers are inserted ⁽¹²⁰⁾.

The Connection of the first phalanges of the fingers with the bones of the *metacarpus* is arthrodia. The first phalanx of the thumb

⁽¹²⁰⁾ The bones of the thumb and fingers are longer in ossifying than those of the *metacarpus*; but at five months after conception, they scarcely differ from those of adults, except in magnitude.

is joined with the bone proper to it of the *metacarpus*, by angular ginglymus; and such also is the union of the subsequent phalanges of the fingers.

The *Use* of the Fingers, in particular, is to support the organ of touch; but they serve, with the bones of the *metacarpus*, and those of the upper extremities, for the performance of labour, and the defence of the body.

Of the Bones of the Lower Extremities.

The *Two Lower Extremities* form the inferior part of the skeleton. They hang on each side, in a right line, from the *acetabula* of the *ossa innominata*, and are divided into

The *Thigh*,

The *Leg*, and

The *Foot*; all which are formed of thirty bones.

Of the Os Femoris.

The *Os Femoris* is the longest bone of the body. It is the most cylindrical, the thickest, and the strongest.

It is situated between the *acetabulum* of the *os innominatum*, and the *tibia*. It is not, however, placed altogether perpendicularly, but somewhat obliquely: so that the superior extremities are at a greater distance from each other than the inferior (See Note 109).

In infancy, the Epiphyses of this bone are manifestly conspicuous (""). It is divided like other cylindrical bones, into its *Body*, or *Middle Part*, and its *Two Extremities*.

The *Body*, which inclines forwards, has three *Surfaces*: the *anterior*, which is convex, and the two *posterior*, which are smooth, and separated from each other by a long, prominent, but unequal line, extended downwards from both trochanters. This line is bifurcated inferiorly, and runs even to the inferior heads of the bone, producing there a smooth, triangular surface. Near this line likewise, there is one or more *foramina*, which lead into the cavity of the bone, and are the passages of vessels to it.

The following *Eminences* and *Cavities* may be seen in the superior extremity of the Thigh bone, viz.

1. The *Head*, which is a sphere, is half covered with cartilage, extends obliquely inwards and somewhat upwards, to be received into the *acetabulum* of the *os innominatum*: nevertheless, the direction of this head is not the same in every skeleton. In the center of this spherical head, there is a small depression,

(121) Its processes at birth are all cartilaginous. It begins to ossify, like the *os brachiale*, a month after conception, and has the same shape at four months as at nine: but its neck continues cartilaginous till about eight months. The inferior epiphysis begins to ossify between the eighth and ninth months, and is the first epiphysis that ossifies in the body, as Dr. Nesbitt says.

in

in which the *Ligamentum Rotundum* is inserted.

2. The *Neck*, which is placed immediately under the head, is smaller above than below, being terminated in an unequal circle, to which the capsular ligament is fastened, and two processes, which are distinguished by the name of *Trochanters*. The direction of this neck is more or less oblique, and the position of the head is consequently various, as a more or less obtuse angle is formed.

3. The *Great Trochanter* is a large, unequal eminence, grown together with the neck, inclined outwards, and opposite the head. Its external surface has very many inequalities for the insertion of muscles. Its internal surface is unequally hollow. In the base of this trochanter there is a particular, deep depression; but the trochanter itself ends in an obtuse point. These parts serve for the attachment of the tendons of contiguous muscles.

4. The *Small Trochanter*, which is turned inwards, is placed posteriorly at the bottom of the neck. It has various eminences for the union of muscles.

Between both trochanters posteriorly there is a *longitudinal line*, by means of which the posterior excavation is enlarged. There is likewise a line, anteriorly between the trochanters, at the end of the neck.

The *Inferior Extremity* is thick and broad, and has the following *Eminences* and *Cavities*.

1. Two

1. Two Large *Condyles* resembling a pulley, which are placed near each other anteriorly, but are at a distance from each other posteriorly, and are consequently divided into the *External* and *Internal Condyle*; of which the former is somewhat larger than the latter, though both are covered with cartilage.

2. The *Round Notch* placed posteriorly between the two condyles, forming the hollow of the ham, and containing and surrounding the popliteal vessels. Besides this notch, there is in each condyle

3. A *Semilunar Notch*, in which the crucial ligaments are fixed. There are many impressions besides for the adhesion of muscles. Laterally there is an eminence and many inequalities in each condyle. Anteriorly there is an excavation between both condyles, to receive the *patella*.

The *Substance* of the body of the thigh bone, as of all other cylindrical bones, is compact; that of the extremities is spongy, that of the cavity is reticular, and filled with marrow.

The *Os Femoris* is connected with three bones; it is connected by enarthrosis above with the *acetabulum* of the *os innominatum*, and by angular ginglymus below with the *tibia* and *patella*.

Its *Use* consists in its forming a principal part of each lower extremity.

Of the Leg.

The Leg is the other part of each lower extremity.

It is placed between the *os femoris* and the foot, and is formed of three bones, viz. The *Tibia*, the *Fibula*, and a small round bone, called the *Patella*,

Of the Tibia.

The *Tibia* is situated between the *os femoris* and the foot, and extended downwards internally and anteriorly. Its figure is cylindrical and almost triangular. It is thicker above than below. Its two extremities are considered as epiphyses in children.

It is *divided*, after the usual manner of similar bones, the substance of which is similar, into a *Body*, and a *Superior* and *Inferior Extremity*.

The *Eminences* and *Cavities* in the Superior Extremity are the following, viz.

1. The *Head*, which is composed of two *Condyles*, one *External* and another *Internal*; both having a deep depression above, lined with cartilage to receive both the condyles of the *os femoris*.

2. A *Double Eminence* between the condyles, for the attachment of the crucial ligaments.

3. The *Popliteal Notch*, which is deep, behind the condyles.

4. The

4. The *Spine of the Tibia*, which is placed anteriorly. The ligament of the *patella* is affixed to it; as is also the tendon of the *extensores* muscles, by which the *patella* is rendered firm.

5. The *Little Depression*, in which the apex of the *patella* is seated, and under which is

6. The *Small Cartilaginous Surface*, which receives the *fibula* posteriorly in the external condyle.

The *Inferior Extremity* is smaller than the superior; it has the following *Eminences* and *Cavities*, viz.

1. The *Longitudinal Cavity* on the outside, which receives the *fibula*.

2. The *Process* on the inside, which is called the *Internal Angle*. There is a furrow in its extremity, in which the tendon of the *tibialis posticus* muscle is fixed.

3. The *Articular Cavity*, which is transverse, and situated inferiorly in the extremity. It is lined with cartilage, and divided into two parts by a smooth eminence, rendered longer by the internal angle. It receives the *astragalus*.

In the body there are three *angles*, and as many *surfaces*: (1.) the *Anterior angle*, which descends from the spine of the *tibia*, is acute above and spherical below: (2.) the *Two Posterior Angles*, one of which is called *Internal* and *Posterior*, being spherical and extended downwards to the internal angle, and the

the other *External* and *Posterior*, the interosseal ligament adhering to this.

The Angles now mentioned separate three surfaces from one another: (1.) the *Internal Surface*, which is between the anterior and the internal and posterior angles is somewhat convex, and covered only by *periosteum* and common integuments: (2.) the *External Surface*, which is narrow, unequal, and limited by the anterior and the external, posterior angles: (3.) the *Posterior Surface* is bounded by the two posterior angles: at about the breadth of the palm of the hand from the condyles, there is a *foramen* in this bone, through which the artery enters its substance.

It is *connected* with four bones: above with the *os femoris* by angular ginglymus, and partly with the internal condyle of the *os femoris* by lateral ginglymus: inferiorly with the *astragalus* by arthrodia: laterally, above and below, with the *fibula* by amphiarthrosis and arthrodia.

The *Tibia* is of use in extending and bending the foot; and also in standing and walking.

Of the Fibula.

The *Fibula* is the other long bone of the leg. It is situated on the outside, but turned somewhat posteriorly, and almost opposite the external posterior angle of the *tibia*.

As to its *Figure*, it is long, cylindrical, small, and unequally triangular.

Its

Its *Structure* differs not from that of all cylindrical bones; and like them, it is divided into its *Body* and *Two Extremities* ⁽¹²²⁾.

The *Superior Extremity* or the *Head of the Fibula* is smooth, and placed obliquely: it has an *articular surface*, covered with cartilage and turned inwards, by which it is joined to the *tibia*. It is terminated posteriorly in an obtuse point. Below the Head is the *Neck of the Fibula*.

The *Inferior Extremity* is broad, and rather oblong: it is almost triangular, forming the *External Angle*, which descends further downwards than the internal angle, and is covered internally with cartilage. The external angle concurs to form the articular cavity for the reception of the *astragalus*. It has a *furrow* posteriorly, in which the tendon of the *peroneus longus* and *medius* muscles pass.

The *Body of the fibula*, which is very small, and bent somewhat inwards towards the middle, resembles an unequal triangular. It has three *angles*, and as many *surfaces*.

To the *Internal Angle* the interosseal ligament adheres, and thence descends so as to come opposite the external posterior angle of the *tibia*.

⁽¹²²⁾ The *Fibula* and *Tibia*, says Dr. Nesbitt, begin to ossify in the same manner, and about the same time, as the thigh bone, and also gradually increase in the same manner, and much in the same proportion (p. 134.).

The *Fibula* is straighter in children at birth than in adults.

The

The *External Superior* and the *External Inferior Angles* are more or less acute.

The *External Surface* is placed between the inferior and internal angle.

The *Posterior Surface* is a little convex above; it is turned inwards inferiorly, together with the external surface, and it is surrounded by the superior and external inferior angles.

The *Internal Surface* is included in the superior and internal angles; but this surface is divided into two by an *oblique line*.

It is *connected* above and below by synarthrosis with the *tibia*, and below by arthrodia with the *astragalus*.

Its *Use*. It establishes the connection with the foot, and renders it more secure.

Of the Patella.

The *Patella* is that little bone situated between the condyles of the *os femoris* over the *tibia*, and immediately upon its spine.

Its *Figure* is unequally triangular, and flat.

It is *divided* into its *Basis*, *Apex*, *Sides*, and *Internal* and *External Surface*.

The *Base* is the thickest part of the bone, turned upwards to the *femur*.

The *Apex* is obtuse and turned to the *tibia*, to the spine of which it is connected by a ligament and the strong tendon before noticed. The apex has a small, unequal depression, in which

which the tendon already mentioned of the *extensores* muscles of the *tibia* is implanted.

The *External Surface* is convex and uneven, being notched towards the basis.

The *Internal Surface* is concave, covered with cartilage, and divided, by a prominent line extended from the apex to the base, into two *articular depressions*, into which the *trochlea* of the *os femoris* is received.

The *Substance* of this bone is internally spongy, and covered externally with a thin *lamella* of compact substance (¹²³).

It is *connected* with the *tibia* by *syndesmosis*, with the *trochlea* of the *femur*, through the interposition of the cartilaginous surfaces, by angular *ginglymus*.

Its *Use*. It renders the articulation of the *os femoris* with the *tibia* more firm, to prevent the body from falling forwards. It serves too as a pulley for the tendon of the *extensores* muscles of the *tibia*.

Of the Bones of the Foot.

The *Foot*, which is the last part of the skeleton, is composed of the *Tarsus*, *Metatarsus* and *Toes*.

We may observe in general, its *Internal* and *External Margin*; its *Anterior* and *Posterior Extremity*; its *Convex Surface*, or the

(¹²³) The *Patella* is wholly cartilaginous at birth. The texture and insertion of the ligaments of the *patella* are most conspicuous in foetus.

Back of the Foot; and its Concave Surface, or the inferior part, or the Sole of the Foot.

Of the Tarsus.

The *Tarsus*, which is situated between the *tibia* and *metatarsus*, consists of seven bones, viz. the *astragalus*, the *calcaneum*, the *os naviculare*, the *os cuboides*, and the three *ossa cuneiformia*.

The largest of these bones are the two first. The two next are small: but the last are smallest.

The *Astragalus* is placed posteriorly and superiorly; it is formed of two parts, the largest, or the *Body*, and the less, which is like a process. That part where these two unite is called the *Neck*.

The *Body*, or posterior part, has a *Superior* and an *Inferior Surface*, and two *Lateral Surfaces*. The *Superior Surface* is large, and covered with cartilage; it resembles the half of a pulley, and is connected to the lower end of the *tibia*.

The *Internal* and *External Lateral Surface* seems to be a production of the superior surface. The *External* is broader than the internal, and is covered by the external ancle. The *Internal Surface* has a large cavity, and is covered by the internal ancle. The *Inferior Surface* is concave and covered with cartilage; it receives the *calcaneum*. There is a furrow

in the external margin to which the capsular ligament is fixed.

The *Process*, or anterior part, is divided from the body, by an excavation above and a large notch below. It has an *Anterior Surface*, obliquely convex, covered with cartilage, and attached to the *os naviculare*. There are two separate cartilages belonging to the *inferior surface*, that are adapted to the *calcaneum*.

The *Calcaneum*, seated posteriorly under the preceding, is the largest bone of the foot, and seems to form its basis ⁽¹²⁴⁾.

Its *Figure* is very irregular.

It is *divided* into its *Body* and its *Anterior and Internal Process*.

There is a rough eminence posteriorly in the body, to which the *Tendo Achillis* is attached.

The *Superior Surface* is divided into two parts; the posterior which is unequal, and the anterior which is convex, covered with cartilage, and entering the concavity of the *astragalus*.

The *Inferior Surface* is narrow, having a double eminence posteriorly, to which the plantar tendon is fixed.

(124) Ossification begins in the middle of the *astragalus* and *calcaneum*, or *os calcis* about the fourth or fifth month after conception.

At birth there are five cartilages supplying the place of the other bones of the *tarsus*.

The

The *Internal Lateral Surface* is a little excavated, so that the passage of vessels, nerves, and tendons of certain muscles may be more easy.

The *External Lateral Surface* is covered only by ligaments and common integuments.

Of the *Anterior or Larger Process* we may notice

The *Uneven Excavation* above, covered with cartilage, receiving the process of the *astragalus*.

The *Eminence* below, to which the *flexor brevis* muscle of the fingers adheres :

The *Surface* before, covered with cartilage, partly concave, and connected to the *os cuboides*.

The *Very Unequal Surface* on the outside, where there is an eminence and concavity in which the *abducens* muscle of the little toe is fixed ; and the *extensor brevis* of the toes.

The *Internal or Lateral Process* coming from the body and larger process. It enlarges the concavity of the internal surface of the *calcaneum*, and has a small cartilaginous surface both above and below.

The *Os Naviculare* is situated internally before the *astragalus*. We may observe in it

The *Posterior Surface*, which is concave, covered with cartilage, and receiving the convex surface of the *astragalus*.

The *Anterior Surface*, which is convex, and divided into three smaller cartilaginous sur-

faces by two lines. These receive the *ossa cuneiformia*.

The *Round Extremity* on the inside of the foot terminated in an obtuse point. It is externally attached to the *os cuboides*. The tendons of two muscles are affixed to it.

The *Os Cubiforme* is placed externally before the *calcaneum*: it has six *Surfaces*.

The *Superior Surface*, which is unequal, and placed towards the back of the foot.

The *Inferior Surface* in which there is an oblique *furrow*, to which the round ligament and the tendon of the *peroneus longus* muscle are both affixed.

The *Posterior Surface*, which is cartilaginous, broad, partly convex and partly concave, receiving the *calcaneum*.

The *Anterior Surface*, which is divided by a line, receives the fourth and fifth bone of the *metatarsus*.

The *External Surface*, which is the least, and has a small *fulcus*, in which the tendon of the *gastrocnemius posticus* muscle is inserted.

The *Internal Surface*, which is the longest, and has two less surfaces; one receiving the *os naviculare*, and the other the *os cuneiforme*.

The Three *Ossa Cuneiformia* situated near one another, before the *os naviculare*; they are like wedges driven between the other bones, and are named accordingly. We take notice, in each bone, of the *Basis*, *Apex*, and four *Surfaces*,

Surfaces, one of which is *anterior*, another *posterior*, and the other two *lateral*.

The *First os Cuneiforme* is the largest. It is placed on the inside of the foot, before the *os naviculare*.

Its *Base* is convex and turned downwards.

Its *Apex* is turned upwards towards the back of the foot.

The *Posterior Surface* is almost triangular, concave, and united to the anterior and internal surface of the *os naviculare*.

The *Anterior Surface*, which is semilunar, receiving the first bone of the *metatarsus*.

The *Internal Surface* is unequal, connected above to the second cuneiform bone, and below to the second bone of the *metatarsus*.

The *External Lateral Surface* is unconnected.

The *Second Os Cuneiforme* is the least: it is placed between the first and third, before the *os naviculare*.

Its *Base* is unequal, short, and turned upwards.

Its *Apex* is turned downwards.

Its *Posterior Surface* is triangular, and connected to the middle of the surface of the *os naviculare*.

Its *Anterior Surface* is contiguous with the other bone of the *metatarsus*.

Its *Internal Surface* is joined to the first cuneiform bone.

The *Third Os Cuneiforme* is situated between the second *os cuneiforme* and the *os cuboideum*. We may notice in it

The *Basís*, which is turned towards the back of the foot.

The *Apex*, which is turned downwards.

The *Posterior Surface*, which is triangular, and joined to the external anterior surface of the *os naviculare*.

The *Anterior Surface*, which is also triangular, receiving the third bone of the *metatarsus*.

The *Internal Lateral Surface*, which is connected above to the other *os cuneiforme*, and below to the second bone of the *metatarsus*.

The *External Lateral Surface*, which is united to the *os cuboideum*.

The *Substance* of all the tarsal bones is spongy.

They are *connected* to one another by amphiarthrosis: anteriorly with the metatarsal bones by synarthrosis. The *Calcaneum* is connected posteriorly and superiorly with the *tibia* and *fibula* by arthrodia.

The *Use* of these bones is to render the foot more flexible, and fitter for the performance of its offices.

Of the Metatarsus,

The *Metatarsus*, the other part of the foot, is composed of five cylindrical bones, which are

are placed contiguous to one another, between the *tarsus* and the toes.

Their *Figure* is oblong and quadrangular ⁽¹²⁵⁾.

We may notice in them,

The *Superior Surface*, which is convex, and the *Inferior* which is concave.

The *Anterior Margin*, turned towards the toes, and the *Posterior* towards the bones of the *tarsus*.

The Two *Lateral Margins*.

Each of these five bones, like all other cylindrical bones, is divided into its *Posterior* and *Anterior Extremity*, and its *Body*.

The *Posterior Extremities* are excavated, and joined to the bones of the *tarsus*.

The *Anterior Extremities*, which are convex, are united to the first phalanges of the toes. Both *Extremities* are covered with cartilage.

The *Metacarpal Bones* differ greatly from one another. The first is the thickest and shortest; the other four are longer; and the posterior extremities of these are larger than the anterior.

The *Body* has three *Surfaces*, and as many *Angles*; it being triangular. One of the *Surfaces* is *Superior*, the rest are *Lateral*.

⁽¹²⁵⁾ The metatarsal bones begin to be formed about two or three months after conception, in the same manner as other cylindrical bones. At birth their form is the same as in more advanced age; but their *extremities* are cartilaginous.

Two of the Angles are on the sides : the third is turned downwards.

These bones are *connected* posteriorly with the bones of the *tarsus* by angular ginglymus ; anteriorly with the first phalanges of the toes by arthrodia.

As to their *Use*, they support the body, when we stand erect : they constitute the back and bottom of the foot,

Of the Toes.

The *Toes* are the last part of the feet, and of the whole skeleton. They are placed at the anterior margin of the *metatarsus*, and distinguished by the names of the *Great Toe*, the *Second*, the *Third*, the *Fourth*, and the *Fifth*, or *Little Toe* ⁽¹²⁶⁾.

As to the *Division*, *Figure*, and *Substance* of the toes, it agrees with that of the fingers : for each is divided into three phalanges ; except the great toe, which has only two. The Phalanges of these are shorter than those of the fingers.

The phalanges of the toes are *connected* with the bones of the *metatarsus* by arthrodia : but the connection of the phalanges of the second series with the phalanges of the first ; and of

⁽¹²⁶⁾ These bones, like those of the fingers, have cartilaginous epiphyses at birth, on both ends. The greatest part of the last bone of all the small toes, says Dr. Nesbitt, is cartilaginous.

the phalanges of the third series, with those of the second, is by angular ginglymus.

The *Use* of the toes is in walking, and in various motions of the body, in which they are as a *fulcrum*.

Of the Offa Sefamoidea.

The *Sesamoid Bones* have gotten their name, from the resemblance which they bear to the *femina lini*. They differ much in size from one another. They are found particularly between the first and second phalanges of the thumb and great toe. They sometimes adhere to the condyles of the *os femoris*, the *os cuboides* of the *tarsus*, &c. ⁽¹²⁷⁾.

The

⁽¹²⁷⁾ *Offa Sefamoidea* are usually found in the following manner; one between the metacarpal bone, and the first phalanx of the little finger, adhering to the tendon of the *abductor* muscle of that finger (Heister, *Comp. Anat. Nota 1^{*}. Edit. Amst. 1748.*): one or two at the second joint of each thumb and great toe (*Ibid.*): one in the external, and one in the internal condyle of each *os femoris* (*Ibid.*): one at the connection of the *os cubiforme* of the *carpus* and *tarsus*, with the metacarpal bone of the little finger, and the metatarsal bone of the little toe (Bartholine, *Anat. Reform.* and Kulm, *Tab. Anat.*).

Schulzius relates that he saw one in a peculiar sinus in the lateral process of the first lumbar *vertebra*, on each side (*Heist. Com. Anat. Nota 1^{*}.*).

It has been imagined by some, that the *Offa Sefamoidea* are mere ossifications of tendinous and ligamentous parts, in consequence of violent and long-continued pressure (Monro's *Osteol.*): hence, their number was thought to be greater in more advanced age. Dr. Nesbitt, on the contrary, always found the places of these bones in *foetus*,

The *Number* of them is uncertain.

Their *Substance* is spongy : they are covered with a thin but compact *lamella*.

The *Use*. They serve for pullies to the tendons ; render their motion easier, and augment their strength,

foetus, only three months after conception, supplied with cartilages of a similar figure. And, moreover, he observes that—" there is not one single bone, except the teeth, or one *epiphysis* in an adult skeleton, which is not to be found in a full grown *foetus*, or in its place a cartilage of nearly the same shape (Hum. Osteog. p. 137.)."

SYNDESMOLOGY,

SECTION I.

Of the Recent Bones.

WE have already observed, that *Osteology* is divided into two parts: of which, the one respects the *Dry Bones*, and the other the *Recent Bones*: we are now come to treat of the *Recent Osteology* as it is called; in which is examined,

1. The *Internal and External Periosteum*,
2. The *Cartilages*,
3. The *Marrow*,
4. The *Articular Glands*,
5. The *Synovia*,
6. The *Vessels and Nerves*,
7. The *Ligaments*.

Of Periosteum.

The *Periosteum* is a thin, but strong membrane, more or less transparent, and very elastic:

tic : extended over the internal (¹²³) and external surface of bones. It covers all the bones of the body, except the teeth. Its *External Surface* is smooth ; but its *Internal Surface* is unequal, because of the unequal surface of the bones to which it adheres. It is variously termed, as it covers different parts : thus, covering the *cranium*, it is called *Pericranium* ; covering cartilages, it is called *Perichondrium* ; and covering ligaments, it is called *Peridesmium*.

The *Structure* of this membrane, which has very many vessels, is composed of different membranous layers, sometimes more, and sometimes fewer, placed one upon another. Again, these layers consist of a series of membranous fibres, which if examined apart, run in a parallel direction : but if examined in the intire *periosteum* are firmly interwoven with one another.

The *Connection* of the *periosteum* is this ; the internal surface of the *periosteum* coheres very firmly, by means of vessels, with the substance of the bones ; the external surface is connected with cellular membrane and muscles. Since, however, in old people, many vessels gradually disappear, become dry, and change into

(128) It is wrong to say there is an internal *periosteum* ; for that which some have chosen to call by this name, is merely the membrane that contains the marrow : besides, its structure is very different from that of the membrane which covers the bones, and is the true *Periosteum*.

fibres,

fibres, the connection of *perioſteum* with bone is not ſo firm in them, as in young ſubjects.

The *Internal Perioſteum* ſeems to ariſe from the veſſels and nerves, which enter into the ſubſtance of bones, and are diſperſed over their internal ſurface. This membrane, which is far thinner than the external *perioſteum*, covers not only the marrow of cylindrical bones, but alſo entirely inveſts all the ſmall caverns of bones (See Note 128.).

The *Arteries*, *Veins* ⁽¹²⁹⁾, and *Nerves* ⁽¹³⁰⁾ of

⁽¹²⁹⁾ The *Perioſteum* is poſſeſſed of very many blood veſſels, which are eaſily injected in *foetus*, and communicate one with another, ſomewhat like thoſe of the inteſtines (Albinus *Icon. Off. Foetus Hum. Fig. CLXII.* and *Annot. Acad. Lib. III. Cap. XI.*): but the *perioſteum* of *foetus* is leſs compact than that of adults, and reſembles a cobweb, as Haller has obſerved (*Sur la Formation des os Obſ. 12. 21. 27. 32. 41. 42. 49. 51. 58. 60. 66. 68. 70. 76. 89.*).

⁽¹³⁰⁾ Though the *perioſteum* has generally been thought to be replete with nerves, yet the more common opinion is that it is inſenſible. Haller ſays—“ The Inſenſibility of the *Perioſteum* was formerly noticed by Cheſelden, “ &c.” (*Acta Gotting. Soc. Reg. Vol. II.*). Neſbitt preſumes that—“ the great ſenſibility, with which it is endowed, is a ſufficient proof of its being well provided “ with nerves, though they are too ſmall to be traced “ (*Hum. Oſteog. p. 6.*). Haller (*Mem. ſur la Nat. ſenſ. et irrit. Tome I.*), and Hunter (*Medical Comment. Part. I. Chap. VIII. p. 64.*), have both agreed not only that *perioſteum* is without nerves; but alſo that experiments on healthy animals, and obſervation deduced from diſeaſed animals, diſprove the ſuppoſition of their preſence.

Baron Haller ſays,—“ I have torn, pricked, and burnt “ *perioſteum* a hundred times; but the animal did not “ evince

of *periosteum* arise from the contiguous parts. They are dispersed every way in numerous ramifications, and resemble a net-work. Some of them penetrate even the cavity of bones.

The *Use of Periosteum* is

1. To receive and direct the vessels, that they may secrete marrow into the internal parts of bones, and nourish them :
2. To connect epiphyses with bones :
3. To be a place of insertion for muscles and tendons : nevertheless some tendons perforate the *periosteum*, and adhere immediately to the bone.
4. To defend bones from the open air, and other hurtful causes ; when a wound shall have been made down to them.

Of the Natural Colour of Bones.

The *Natural Colour of the Recent Bones* is various : some are white, some are red, and some are bluish. Besides, the compact substance of bones is white : the spongy substance is red, and somewhat blue. Hence, the body

“ evince the least sign of pain : and what is more, young kids have continued sucking : yet, if I pinched the skin, they bore it impatiently, and became convulsed (*Acta Gott. Reg. Soc. Tom. II.*).”

As to the opinion that *periosteum* is continued from the *dura mater*, an opinion which was particularly supported by Clopton Havers (*Ost. Nov. Disc. I.*) ; we shall hereafter endeavour to prove that this latter is not sensible : so that no argument whatever can be deduced from this, to prove the sensibility of *periosteum*.

of cylindrical bones is white, but their extremities are always red.

Age likewise causes a difference in the colour of bones. The bones of adults are generally white; but those of children are reddish. This, however, is only said of the body and compact substance of bones: for, in old people, the spongy substance of bones is somewhat brown.

In the prime of life, all the bones are manifestly redder than in old age: for many vessels which are permeable in the bones of the former, and transmit red blood, gradually coalesce in the latter. But this is not meant universally of all subjects of the same age: for the various kinds of life produce a notable difference in this respect. The bones of a man accustomed to hard labour from childhood, become firm and compact sooner, from the continued motion; because the vessels running between the bony *lamellae* are thereby compressed, changed into fibres, and are consequently sooner white, than the bones of men, who lead an easy and indolent life ⁽¹³¹⁾.

The *Teeth* of Europeans and others is of a greyish pearl colour, like the *tunica albuginea* of the eye; but the Teeth and the *tunica albuginea* are both alike of a snowy whiteness, clearly distinct from that of others, in Ethiopians.

⁽¹³¹⁾ The appearance of the recent bones depends principally on the size and number of blood-vessels, with which they abound; as may easily be conceived.

The Bones of men, who have used mercurial inunction, or taken mercury inwards, to cure the venereal disease, are never so white as is requisite to make an elegant skeleton; and can never be employed for such a purpose.

A knowledge of the natural colour of the bones is very useful, and oftentimes altogether necessary to a Surgeon; not only because of different diseases and wounds, but also because of operations performed in the vicinity of bones.

It must be noticed also, in this place, that it becomes a Surgeon to be well acquainted with the inequalities of bones; their roughness, hardness, and smoothness, lest in a diseased state, he mistake that which is natural for that which is unnatural.

Of Cartilages.

Cartilage is a firm, smooth, and elastic body, of a pearl colour, very closely attached to the extremities of bones, which it covers.

Its *Firmness* or *Hardness* is of a middle kind, between that of bone and ligament ⁽¹³²⁾.

The *Substance* of cartilage seems to consist of a coagulated and inspissated jelly, inter-

⁽¹³²⁾ It is worthy of notice that the external part of cartilage is the softer and more elastic, as was long ago observed by Clopton Havers (*Off. Nov. Disc. V.*). This is the cause, that injury so seldom happens in the joints from violent concussions.

perfed with peculiar fibres. It is at leaft certain, that the component parts of cartilage are always of a cartilaginous, and never of a bony nature (¹³³).

The *External Surface* of cartilage is fmooth, equal, and invested by a thin membrane, which is called *Perichondrium*, and confidered as a continuation of *periofteum*: nevertheless it is much thinner than *periofteum*, and feems endowed with lefs fenfibility (¹³⁴).

There are neither cavities nor cells in cartilage; confequently, it contains no marrow, no medullary fluid. There are no pores manifeft in it, but it has minute *foramina* for the paffage of very fmall veffels (¹³⁵).

Cartilages are divided in a threefold manner, according to their

1. *Figure,*

(¹³³) Dr. Nefbitt fays—"The long macerations of "the great Anatomift Dr. Nichols feem to prove, that "cartilaginous fubftances are fibrous, although the "fineft microfopes do not difcover the difpofitions or "courfes of the fibres (Hum. Off. Lect. I. p. 8.)."

The diffection of Embryos proves that cartilage is originally a very jelly, as has been obferved by Nefbitt (Human Osteog.), Albinus (*Icon. Off. Foet. Hum.*), Haller (*Deux Memoires fur la formation des Os, fondés fur des experiences*), and other eminent Anatomifts. It is proved from the analogy between jelly and cartilage, both appearing fimple, and flexible, and differing only in this, that cartilage is more compact, and elastic. But if we recede from a mere furvey, and rely on experiments, it will be plain that this cartilage, of which we are now fpeaking, is very different from what it feems to be (Note 135.).

(¹³⁴) *Perichondrium* is eafily feparable in *foetus*.

(¹³⁵) Cartilage has blood-veffels, as was obferved by Havers (*Off. Nov. Difc. V.*). The cartilages that fupply

1. *Figure*,
2. *Situation*, and
3. *Use*.

As to their *Figure*, they are convex or concave, hemispherical, femilunar, triangular, oblong, oval, or of no determinate figure.

Cartilages are called from their *Situation*, *interarticular*; because they are placed in the articulation of bones. To this kind may be referred the *Cartilages* between the condyles of the *os femoris* and *tibia*, the cartilages in the articulation of the lower jaw; of the *sternum* and clavicle, &c.

By reason of their *Use*, *Cartilages* are called *Obducentes*, when they cover the condyles at the extremity of a bone, or line articular cavities: or they are called *Uniting Cartilages*, when they unite two bones firmly together (¹³⁶).

The

ply the place of bone in the adult, e. g. in the Nose, Ribs, &c. and that which supplies the place of bone in *foetus*, are easily shown to be vascular (Note 136.). But the cartilage that covers the heads of bones serving for articulation, is only supposed to be vascular from its becoming yellow in jaundice, from its ulcerating, and from its uniting with other parts. This last kind of cartilage cannot be injected; neither does it become red in inflammation. It will not exfoliate, neither will it granulate. It is without sensibility. Consult the *Phil. Transf.* Vol. 42. and Dr. Hunter's *Medical Commentaries*, Chap. VI.

(¹³⁶) There are other kinds of cartilage, of which Leber has made no mention: one supplies the place of bone in *foetus*, and is only found in them, viz. the epiphyses of bones: another is employed by nature instead

The *Use* of Cartilages is :

1. That by their smoothness, and the slipperiness of their surface, they may enable the bones, connected by moveable articulation, to roll over one another with ease, and without friction ; so that by this mechanism, articular motion is rendered freer.

2. That by their flexibility, they may acquire the form requisite to various motions.

3. That being peculiarly elastic, they may resume their natural situation, and form, upon the removal of pressure. The elasticity of the cartilages may likewise conduce to the easier and freer motion of joints.

4. They render the articulations lubricous, and preserve them so.

5. Lastly, they unite various immoveable bones firmly together.

Of Marrow.

The *marrow of bones* is a very fat, oily part of the blood, one while fluid and another while of a thicker consistence, contained not only in the internal cells, but also in the medullary tubes of cylindric bones (¹³⁷).

We

stead of bone in adults, where it gives form to parts, and is not so liable to be broken as bone, viz. the cartilaginous part of the nose, external ear, *aspera arteria*, and Xyphoid Cartilage. The division of cartilages adopted by Leber is similar to that of Celsus (*De Medic. Lib. VIII. Cap. I.*).

(¹³⁷) The use of the Marrow is said, in Note (140), to be to supply the body with nourishment, when the blood has

We have already said that all the body, cells and small caverns of bones are invested with an internal *periosteum*. Now it is this which produces so many follicles or small sacks there, which are divided into cells and cellular vesicles fit to contain the marrow; all the orifices of which cells communicate freely one with another, so that the marrow when dried seems to resemble a bunch of grapes, or a series of small globules connected together laterally. This texture does not differ much from that which is observed in other cellular parts containing fat, except that this which contains marrow is by far more fine and subtile.

Marrow is separated from the blood by means of arteries, penetrating the substance of bones, and divided into innumerable, small ramifications; by which it is deposited in proper cells. The blood which remains, after the separation of the marrow, is taken up and carried back by the veins, through the same passage, to the general mass.

As age advances, the number of these small vessels decreases (¹³⁸); for although the larger trunks

has ceased to do it. But there is a use of the marrow that may very properly be noticed here; which is that by filling up the cells and cavities of bones, it renders the bones stronger, and still co-operates with the design of nature, in preserving them lighter than if they were solid bone, without cells or cavities.

(¹³⁸) From the experiments of Sir Clifton Wintringham, it is proved, that the force of the blood in the arteries decreases with age, and that the veins increase both

trunks of the vessels, destined for the secretion of marrow, become daily greater as the body enlarges, the capillary ramifications arisen from them are gradually obliterated; and, the redness of the marrow is more or less intense, in proportion as the number of these is greater or less. Hence the reason is evident, why marrow is red in infancy, yellowish in manhood, and watery and limpid in old age.

Marrow is insensible; but the cells, in which it is contained, are very sensible. This is evinced by painful diseases which occur in the middle of bones (¹³⁹).

The *Use of Marrow*. It transudes between the *lamellae* of bones, and lessens their fragility; for it moistens them, so that they may easily yield, and consequently resist the force of external causes.

The truth of this is confirmed by experience, which teaches us that fractures happen more readily in men, whose *medulla* is corrupted, and easier in old than in young men, even though the latter be more frequently liable to them (¹⁴⁰).

Marrow

both in density and strength: so that it is clear how the extreme arteries, which deposite the *Medulla*, gradually become collapsed and obliterated as the *Vis à Tergo* ceases to dilate them by driving the blood onwards.

(¹³⁹) Deventer, Ambrose Paré, Du Verney, and others have asserted that marrow is sensible, but they could certainly mean only that the medullary membrane is sensible. Such is the opinion of Haller (*Mém. sur les par. sens. et irrit.*).

(¹⁴⁰) So say Haller (*Prim. Lin. § XXIV.*) and Sabatier (*Tome Prem. p. 16.*). But as their proofs are derived

Marrow also prevents *anchylosis*, by transfusing through small *foramina* into the cavity of joints, where, mixed with other liquors, it constitutes *synovia* ⁽¹⁴¹⁾.

The

derived from such conditions of the vesicles containing *medulla*, as can never exist during the life, or health of the part, their opinion avails nothing. We agree with Haller in attributing the transparency of the bones of an imperfectly prepared skeleton, or of diseased bones in the living subject to the transfusion of *medulla*; but we differ from him in supposing that a similar transfusion takes place in the living body. For we imagine, that the greasiness of bones, or any other sign of transfusion can only happen from a destruction of the medullary cells, in consequence of putrefaction, or some other cause. Hall's experiments clearly prove that the fragility of bones is not lessened by the marrow (London Med. Journal, Vol. 7. p. 157.).

Mr. Cruickshank rejects the opinion of Leber, Sabatier, and Haller, and considers that an evaporation of the watery parts, and a consequent dryness must necessarily precede the transfusion of oil, even though the medullary membrane and cells be broken (Of the Absorbent System, p. 12.): but we cannot assent to this explanation of Mr. Cruickshank, as we are dubious, whether a bone moistened with the animal fluids refuses to imbibe and transmit *medulla*, for the same reason as paper moistened with water does not suffer the passage of oil through its pores. We know no proof that the bones are nourished by *medulla*, as asserted by some authors (*Halleri Elem. Physiol.*). But we have every reason to believe that the use of the marrow, as well as of the fat, is to be absorbed into the system, when the blood does not supply it with nourishment.

⁽¹⁴¹⁾ Such is likewise the opinion of Haller (*Primae Lineae* § xxiv.) and Sabatier (*Tome Premier*, p. 16.); who contend that marrow transfuses through the thin cartilaginous shell covering the *epiphyses*, which opinion was once embraced by Clopton Havers (*Disc.* 3.), who confesses indeed that the pores are very small, though numerous,

The Haversian or Articular Glands.

These are particular, soft and tender glands placed in the articulations. They are spoken of more fully in the Adenology.

These glands have so commodious a seat in joints, that they may easily be pressed, but can never be bruised, except by very great violence. They are situated generally at the margin of the capsular ligament; or in particular hollows and cavities of the joints.

The liquor of these glands emulged by gentle pressure, and combined with other liquors, which flow into the cavity of joints, renders their motion easier, and obviates the exsiccation, friction and wasting of the cartilages.

numerous, and hard to be discovered. Moreover he says, he had a bone of a horse, in which they were very conspicuous; visible to the naked eye.

Now modern Anatomists say nothing of such pores; and should it be granted, as it is, that cartilage is vascular, becoming yellow in jaundice, nevertheless if a cartilage be immersed and soaked in a coloured liquor, it does not become tinged, although Haller shall have asserted it, upon the authority of his very good friend Benedict Stachelinus (*Elem. Phys. Tom. I.*).

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Synovia.

Synovia is a liquor almost like the white of an egg, contained in the cavity of joints by the capsular ligaments.

It consists of

1. The *mucilaginous liquor* of the articular glands:

2. The *oleaginous part of the marrow* which transudes through small pores of the extremity of bones, into the cavity of joints: and

3. The *watery part*, which exhales from the ultimate ends of very small arteries opening into joints, from the internal surface of the articular ligaments (¹⁴²).

The *Use* of this liquor is, to keep all the parts of joints flexible, smooth and glib, that they may roll easily upon one another; hence it prevents the reciprocal attrition and concretion of the joints.

(¹⁴²) Dr. Monro thinks that *synovia* is furnished by invisible exhalent arteries, by the ducts of *fibriae* (hanging within the joints and *bursae mucosae* from masses of fat,) and by oil exsuding from the adipose follicles by unknown, undiscovered outlets. But Dr. Monro admits of an exudation from adipose membrane, which we cannot; and he confesses that the oil is, at all times, so well incorporated with the mucilage, that he could not distinguish globules in *synovia*, when aided by the microscope (A Description of all the *Bursae Mucosae* of the Human Body, &c.)! There is no proof that marrow, or oil, is necessary to the formation of *Synovia*.

Of

Of the Vessels and Nerves of Recent Bones.

Bones have always their *arteries* and *veins* arising from contiguous parts. The arteries in *periosteum* are distributed through all the external parts of bones, cartilages, ligaments and articular glands. They enter the interior substance of bones, through small pores situated between their *lamellae*; they are again distributed in the internal *periosteum*, extended over the cells of bones, like a net, and there secrete marrow, or a liquor like marrow ⁽¹⁴³⁾.

Their *use* is to nourish the bone, and to separate that oily liquor, which we call *medulla* ⁽¹⁴⁴⁾;

The

⁽¹⁴³⁾ There are two orders of arteries in bones, the one external and distributed through their substance, the other entering the cavity of bones, and being distributed through the medullary membrane. These two arteries do not often communicate with each other. It is the latter that is called the medullary artery.

⁽¹⁴⁴⁾ Mr. Cruickshank observes also, that when a bone is diseased, the lymphatic glands in its vicinity become inflamed and suppurate, which could not happen unless lymphatic vessels arose from bones; besides, he says, he injected the lymphatics of bones, which puts the matter out of doubt (page 49.).

OSTEOGENY treats of the formation and growth of bones. We have seen in the former chapter, *On the Vessels and Nerves of Bones*; that bones are as vascular as most parts of the body, though from their opacity and the smallness of their vessels, this can only be discovered after disease, or after putting bones previously injected, into diluted marine acid, so as to dissolve the earthy part, and leave only the vessels and membranous part behind, and afterwards preserving them in oil of turpentine.

Haller,

The *Nerves* of bones also come from contiguous branches, enter the internal *foramina* before

Haller, and many others, have imagined that cartilage is indurated jelly, and that bone is nothing more than cartilage replete with earthy matter (Note 133.). This however is not true, for the places of the bones of the skull are not pre-occupied by cartilages, but by membranes. Besides, if bones were nothing but cartilage filled with earth, why do we not obtain cartilage again, after soaking bones in diluted marine acid?

Dr. Nesbitt describes two kinds of ossification: viz. the one which takes place between membranes, as is the case in many bones of the *cranium*, and most of the flat bones, and the other which takes place in cartilage (HUMAN OSTEOGENY.).

Ossification between membranes takes place in consequence of the deposition of bony particles in regular lines so as to form differently disposed orders of lines, or fibres, according to the figure of bones. The ossification of flat bones commences in their centre.

Ossification in a cartilage takes place in the following manner. The cartilage becomes visibly inflamed and vascular, bony matter is deposited, and the cartilage, at least the greater part of it, is absorbed. The whole of the cartilage however is not absorbed, for some of it remains and covers the extremities of bones. In cylindrical bones, ossification begins in the middle and extends towards the extremities.

As the point of ossification appears very vascular and inflamed, it is probable that these appearances depend on the deposition of the earthy matter by the extremities of arteries. For Dr. Nesbitt says, that, in the vessels going to the points of ossification, and near to the points of ossification, "you will rarely miss feeling, by the point of a knife, bony particles (p. 19.)."

Du Hamel was of opinion that a bone is formed of the layers of *periosteum* gradually ossifying, in the same manner as timber is formed by the hardening of the white substance found between the inner bark and the wood. Du Hamel asserted that, on examining the bones of animals that had lived

before noticed, and extend themselves throughout the internal and external parts of bones. Their presence is manifestly evinced by the very ungrateful sensation which accompanies most diseases of bones.

lived one while on madder, and another while on their ordinary food, he always found distinct layers of a red and white colour, corresponding in number and appearance with the times of their living on madder and ordinary food, and the duration of these times. But Detleff's experiments have since rendered it certain, that neither *periosteum*, nor cartilage is tinged by madder.

It is most probable that the arteries themselves form bone; and that they do it seems evident from the enlargement of cylindrical bones, the cavity of which is very small in young animals, but becomes larger as the animals grow older, always, however, bearing a certain proportion to the size of the bones. This enlargement can only depend upon the deposition of osseous matter on the surface, and the absorption of osseous matter from the cavity of bones. Hence it is that the skull enlarges during growth, and that, in old persons, the *alveoli* are absorbed.

In the disease called *Necrosis*, when a part of a cylindrical bone is destroyed, nature separates the dead from the living parts; and when the marrow is destroyed, nature forms a new bony cylinder, either in part, or entirely, according as a part or the whole of the marrow is removed (*Troja, De Novor. Off. Regeneratione.*).

SECTION II.

SYNDESMOLOGY.

Of the Ligaments in general.

LIGAMENTS are white, strong, and elastic membranes destined for the connection of bones, whether moveable or immoveable.

Ligament is thicker and stronger than common membrane, but neither so strong nor so hard as cartilage; so that it seems to be of an intermediate nature between both ⁽¹⁴⁵⁾.

The *Fabric* of Ligaments consists of many very small, robust fibres, interwoven one with another, which, according to their situation, form a *broad* or a *thin ligament*, or a *ligamentous expansion*.

Ligaments are divided into,

1. *Articular*, properly so called, by which the extremities of two bones are joined together, to make a moveable articulation.

(145) Dr. Hunter observed that, "the marks of a cartilage are these; in the fresh subject it appears uniform, and without any visible fibres; and, when cut in any direction, its surface appears smooth like wax or glue. But a ligament is a composition of visible fibres, and, when cut through, has an uneven surface (Med. Obs. and Inq. Vol. II. p. 333.)."

2. Li-

2. Ligaments, by which either two bones are connected by an immoveable union; or by which other parts, especially muscles adhere, and have their motion thereby facilitated.

To the former class belong

1. *Capsular Ligaments.* These arise from the whole circumference of the extremity of one bone, and are affixed to that of another, in a similar manner.

They connect bones, lest they should recede from the articulation, and they prevent the escape of *synovia*: such, for example, are the ligaments which conjoin the *os femoris* with the *os innominatum*, the condyle of the lower jaw with the *os temporum*, &c.

2. Ligaments which do not embrace the whole circumference of a bone, but being only attached to some lateral part, connect it with another.

3. Ligaments, which though within a joint, yet serve to connect two bones together: for example, the crucial ligaments which connect the head of the *tibia* with the condyles of the *os femoris*; the round ligaments by means of which the head of the *os femoris* is confined in its *acetabulum*, &c.

The latter class comprehends

1. The *Ligaments* which connect two immoveable bones together: for example, the ligaments of the *os sacrum*, &c.

2. The Ligaments connecting cartilage with bone: for example, those by which the apex

apex of the *sternum* is joined with the cartilage of the seventh rib.

3. The Ligaments joined to bones and cartilages, yet serving for other parts, especially muscles, or their tendons, to retain them in their place, to direct them, confine them, and render their direction more determinate in some kinds of motion. Such are the annular ligaments, the transverse ligaments, Poupart's ligament, the interosseous ligaments, the *obturator* ligaments, the cervical ligament, &c. All of which are intended for the connection of muscles.

Ligaments have numerous vessels. The *Arteries* open upon their internal surface, and exhale a liquor, which united with *synovia*, keeps the ligaments always moist and flexible. The *Veins* absorb the residuary blood, and carry it into the general mass. These vessels, and likewise the *Nerves* always arise from adjoining parts ⁽¹⁴⁶⁾.

It is plain then, from what has been said, that the motion of the bones of a joint is more easy and free, the less the ligaments are, and the weaker and longer they are; but on the contrary, that the motion is more limited,

⁽¹⁴⁶⁾ Ligaments have very few blood-vessels or nerves. They have hardly any sensibility at all.

A Ligament differs not in its structure from a tendon; both are composed of glistening, inelastic fibres, and both are scarcely, if at all, sensible. A Ligament, however, differs from a tendon in this, that it connects bones to one another, but tendon connects muscles to bones.

in

in proportion as the ligaments are larger, or shorter, and more robust.

The Use of ligaments. Capsular ligaments connect two bones together, and obviate the efflux of *synovia*. The other ligaments join bones together, and preserve them in their proper situation. Moreover, the tendons of muscles are fastened to ligaments.

The Ligaments of the Lower Jaw.

The Ligaments by which the condyles of the lower jaw are fixed to the articular cavities of the temporal bones, are these: viz.

1. The *Capsular Ligament*, which is composed of firm and strong fibres, arising from the circumference of the articular cavity of the temporal bone, are attached to the cartilage within the articulation⁽¹⁴⁷⁾; and, at last, to the neck of the articular condyle of the lower jaw, in its whole circumference.

2. The *Lateral Ligament*, which arises from the internal surface of the angle of the lower jaw, near its posterior *foramen*, and is fixed

(147) Mr. Hunter, speaking of this interarticular cartilage, says it is connected with the articular surface of the temporal bone and the condyle of the lower jaw, by two distinct ligaments, independent of the exterior capsular ligament mentioned in the text, which is common alike to both the temporal and inferior maxillary bone. That by which the cartilage is attached to the temporal bone is the more free and loose, though both ligaments admit of an easy gliding motion on the surface of the temporal bone, and the condyle of the lower jaw (*Natural History of the Human Teeth*, page 11.).

to the posterior margin of the articular cavity of the temporal bone.

The Ligaments connecting the Os Occipitis with the vertebrae of the Neck.

The articular condyles of the *os occipitis* are confined to the articular cavities of the first cervical *vertebra*, and to the other *vertebrae* of the neck, by means of the following ligaments:

1. The *Capfular Ligament*, which arises on each side from the basis of the articular condyles of the occipital bone, and are both inserted near the margin of the articular cavities of the first *vertebra* of the neck.
2. The *Broad Anterior Ligament*, arising from the anterior margin of the great occipital *foramen*, adheres to the anterior arch of the first cervical *vertebra*, between the superior oblique process and the eminence which constitutes the body of this *vertebra*.
3. The *Broad Posterior Ligament*, which is less firm than the former, arises from the posterior margin of the great occipital *foramen*, and adheres to the posterior arch of the first cervical *vertebra*, which is extended from the superior oblique process as far as the eminence which supplies the place of a spinous process, in this *vertebra*.
4. The *Ligament of the odontoid process*. It arises at the anterior margin of the great occipital

occipital *foramen*, and is affixed to the odontoid process of the second cervical *vertebra*.

5. The *Cervical Ligament* arises by a very broad beginning from the posterior protuberance of the *os occipitis*; as it descends, it becomes less, and is connected to the spinous processes of the *vertebrae* of the neck, by means of its extremities.

The Ligaments of the other Vertebrae.

All the *vertebrae* are joined together by the following ligaments, some of which are *proper* to particular parts, and some *common* to the whole spine: viz.

1. The *Transverse Ligaments of the first vertebra of the neck*, which arise internally from each side of the anterior margin of the first cervical *vertebra*, are extended transversely to the opposite side, and attached to the odontoid process of the second *vertebra* of the neck: These ligaments retain the odontoid process, now mentioned in its proper situation, while the head is turned to either side.

2. The *Posterior Common Ligament of the vertebrae*. This is strong and broad; it arises from the first cervical *vertebra*, covers the convex surface of all the *vertebrae*, adheres to them, and is lastly terminated at the *os sacrum*.

3. The *Anterior Common Ligament of the vertebrae*; it is broad, takes its origin from the odontoid process of the second *vertebra*.

of the neck, covers the internal or concave surface of all the *vertebrae*, adheres to them, like the former, and is extended as far as the *os sacrum*.

4. The *Interspinal Ligaments*, which are short and firm, running in the course of the spine, from one spinous process to another, so as to connect them all together.

5. The *Intervertebral Ligaments*. They arise from the margins of the *vertebrae*, begin at the second *vertebra* of the neck, and pass in a decussated direction from one *vertebra* to another.

6. The *Intertransverse Ligaments*, which are short and small, placed between the transverse processes, and pass from the apex of one transverse process to that of another, situated above it.

7. The *Capular Ligaments of the oblique processes*, which adhere on all sides to the oblique processes.

8. The *Ligaments which connect the last vertebra of the loins to the os sacrum*. These are of the same kind as those belonging to the other *vertebrae*. They join the *os sacrum* with the last lumbar *vertebra*.

The Ligaments by which the Ribs are connected with the Sternum.

The two following ligaments are proper to the *Sternum*, besides those which join the clavicle and ribs with it, of which mention is made hereafter.

1. The

1. The *Proper Membrane of the sternum*, is a firm, tendinous expansion, composed of longitudinal fibres, and covering the external and internal surface of the *sternum*.

2. The *Ligaments of the Xyphoid cartilage*, which arise, one on each side, from the cartilages of the seventh ribs, and contiguous parts of the *sternum*, and descend from thence obliquely to be inserted into the Xyphoid cartilage.

The *Ribs* are united posteriorly with the *vertebrae*, and anteriorly with the *sternum*, by means of ligaments.

The *Ligaments fastened to the posterior extremities of the ribs*, are these: viz.

1. The *Capsular Ligaments of the great heads of the ribs*, which arise from around the great head of each rib, and end by broad fibres in the circumference of the articular cavities of the *vertebrae*. Therefore the greater heads of the ribs are united with the bodies of the *vertebrae*, by means of these ligaments.

2. The *Capsular Ligaments of the small heads of the ribs*, which arise from the circumference of the small head of each rib, their extremities being connected with the articular cavity in the apex of each transverse process of the dorsal *vertebrae*.

3. The *Internal Ligaments of the neck of the ribs*; they begin at the superior margin of the neck of the ribs, and end on the inferior

surface of the transverse process of the dorsal *vertebra*, next above it.

4. The *External Ligaments of the neck of the ribs*; they arise from the external surface of the superior margin of the neck of all the ribs, ascend obliquely, and are inserted into the external margin of the inferior oblique process of the dorsal *vertebrae*, placed above it. This ligament is wanting in the first dorsal *vertebra*.

5. Two *Peculiar Ligaments*; which having arisen by broad fibres from the inferior margin of the last rib, are connected with the transverse process of the first and second lumbar *vertebrae*.

The *Ligaments fastened to the anterior extremities of the ribs*, are these: viz.

1. The *Capsular Ligaments of the cartilages of the true ribs*; which arise, on all sides, from the extremities of the cartilages of the seven superior true ribs, and are terminated in the circumference of the articular cavities of the *sternum*. Many fibres go from the anterior surface of these ligaments, and run over the external surface towards the opposite side, like rays.

2. The *Proper Ligaments of the ribs*; by which the ribs cohere to one another; they descend from one cartilage in a direction directly perpendicular to another; they are united to these, and the cartilages of the five inferior spurious ribs are joined one to another.

The

The Ligaments of the Bones of the Pelvis.

The *Ligaments* by which the *Ossa innominata* are joined with each other, and with the *os coccygis* and *vertebrae* of the loins, are these: viz.

1. The *Three Posterior Ligaments of the os ilei*, or the *Ileo-sacral Ligaments*, which are thick and strong, arise from the posterior iliac spine, descend from thence obliquely, and terminate in the first, third and fourth spurious transverse process of the *os sacrum*.

2. The *Two Sacro-ischiatic Ligaments*; which arise by a broad beginning from the fourth spurious transverse process, the lateral part of the *os sacrum*, and the basis of the *os coccygis*; their fibres are contracted as they descend, are broader anteriorly, and inserted obliquely into the spines of the *os ischii*.

3. The *Superior and Inferior transverse ligament of the pelvis*; these two ligaments arise from the posterior margin of the *os ilei*, pass transversely in such a manner, that the superior is extended to the transverse process of the last lumbar *vertebra*, and the inferior to the first transverse process of the *os sacrum*.

4. The *Obturator Ligament of the foramen ovale*; it arises from the surface of the margin of the *foramen ovale*, and has an aperture in the superior part of the *foramen ovale*, for the passage of the *obturator vessels* and *nerves*.

This place. is likewise the seat of some kinds of *herniae*

5. The *Inguinal Ligament*, or *Poupart's* or *Fallopian's Ligament*. This strong ligament consists principally of the tendinous expansion of the oblique descending abdominal muscle. It arises from the inferior iliac spine, and is terminated at the *crispa* of the bones of the *pelvis*. The femoral vessels go from the *pelvis* under this ligament, and the *Herniae*, which are called *Femoral*, are in this place.

6. The *Capsular Ligament of the os coccygis*; which surrounds the basis of the *os coccygis*, and the apex of the *os sacrum*.

7. The *Longitudinal Ligaments of the os coccygis*; they arise from the internal surface of the *os coccygis*, and terminate in the *os sacrum*. These three ligaments render the connection of the *os coccygis* with the *os sacrum* more firm.

Ligaments of the Clavicle and Scapula.

The *Clavicle* adheres anteriorly with the *sternum* and first rib; posteriorly with the *scapula* by means of the following ligaments:

1. The *Interclavicular Ligament*, which is narrow, long, and strong, runs along behind the *sternum* from the anterior extremity of one clavicle to another.

2. The *Anterior Capsular Ligaments of the Clavicle*. These are two short robust ligaments arising on each side from the circumference

ference of the anterior extremity of the clavicle, and terminating in the margin of the articular cavity of the *sternum*, which receives the clavicle.

3. The *Rhomboid Ligaments*, which arise on each side from the inferior rough surface of the anterior extremity of the clavicle, and pass obliquely from hence to the first rib, to be attached to its cartilage.

4. The *Posterior Capsular Ligaments*, which are small but strong, embracing the posterior extremity of the clavicle and the *acromion scapulae*, and connecting them to each other.

The *Scapula* is joined with the posterior extremity of the clavicle by the following ligaments:

1. The *Trapezoid Ligament of the Scapula*, which arises from the internal surface of the coracoid process, is inserted into the posterior extremity of the clavicle.

2. The *Conoid Ligament of the Scapula*; it arises from the root of the coracoid process, and is inserted into the rough eminence of the posterior extremity of the clavicle.

3. The *Proper Anterior Ligament of the Scapula*. It arises from the external surface of the coracoid process, and is attached to the posterior margin of the *acromion*.

4. The *Proper Posterior Ligament of the scapula*. It arises from the middle of the superior margin, and terminates at the root of the coracoid process.

The Ligaments of the Shoulder.

As the superior extremity of the *humerus* adheres to the cavity of the *scapula* by means of ligaments, so does the inferior to the bones of the fore-arm.

The *Capsular Ligament of the Shoulder* arises by a circular beginning from the head of the *os humeri*, and adheres on every side to the margin of the glenoid cavity of the *scapula*. There is a longitudinal opening in the superior part of this ligament, through which the second tendon of the *biceps* muscles passes downwards to the superior part of the articular cavity. Moreover, this ligament is augmented by tendinous fibres from the tendons of contiguous muscles.

The Ligaments of the Bones of the Fore-arm.

The Bones of the fore-arm are joined to the *os humeri*, to one another, and to the *carpus* by various ligaments.

The *Ligaments of the cubit* are,

1. The *Capsular Ligament*, which surrounds the inferior extremity of the *os humeri*, descends upon its condyles, and attaches itself to the sharp margin of the cubital tubercle and *corona*, and to the capsular ligament of the *radius*.

2. The *Brachio-cubital*, or the *Internal Lateral Ligament*; which arises from the superior and anterior eminence of the articular condyle of the *os humeri*, descends over the

the capsular ligament, and is implanted in the internal side of the coronoid process of the *ulna*.

3. The *Brachio-radial*, or the *External Lateral Ligament*. It arises from the internal condyle of the *os humeri*, ascends over the capsular ligament, and unites with the coronary ligament of the *radius*, by expanded fibres.

The *Ligaments of the radius* are,

1. The *Coronary* or *Orbicular Ligament*, which begins at the posterior margin of the semicircular cavity of the *ulna*, and is inserted near the circular margin of the superior head of the *radius*.

2. The *Capsular*, or *Sacciform Ligament*. It arises anteriorly from the margin of the semilunar notch in the inferior extremity of the *radius*, and loosely invests the whole head of the *ulna* posteriorly. These two ligaments concur to facilitate the motion of the *radius*, inwards and outwards.

3. The *Capsular Ligament*. This arises from the circumference of the margin of the glenoid cavity at the inferior extremity of the *radius*, and inferior head of the cubit. It encompasses the first three bones of the *carpus*.

4. The *Two Transverse Ligaments*. One of these passes downwards from the articular cavity of the *ulna* to the unciform and cuneiform bones of the *carpus*, the other goes from the styloid process of the *radius* to the *os naviculare*.

5. The *Oblique Ligament*. It arises from the smaller protuberance of the *ulna*, obliquely fills

fills the space intercepted superiorly by the interosseous ligament, and goes and attaches itself to the *radius* and its tubercle.

6. The *Interosseous Ligament*. It is broad and strong, filling the space between the *ulna* and *radius*. It is affixed to the internal angle of the *radius*, and to the external angle of the *ulna*. It intercepts a space, as hath been observed, near the superior extremity of the bones of the Fore-arm, which space is occupied by the oblique ligament.

This ligament is composed of fibres mutually decussating one another, and intercepting small spaces here and there, through which vessels pass. Many muscles adhere to the two broad surfaces of this ligament.

Ligaments of the Carpus.

The *Bones of the wrist* are united with one another, with the fore-arm, and the bones of the *metacarpus* by the following ligaments.

The *Proper Ligaments of the wrist* are,

1. The *Capsular Ligament*, common to the *carpal bones*, or that by which the first series of bones in the *carpus* is joined with the second.

2. The *Short Ligaments of the bones of the carpus*. These are small and short ligaments, by which the bones of the *carpus* are connected into one continued series, and these series connected together. They are called *oblique*, *transverse*, *capsular*, and *proper ligaments of the bones of the wrist*.

We

We have already spoken of the *Ligaments*, which connect the *carpus* with the fore-arm ; and, as for those which connect it with the metacarpal bones, we shall mention them in speaking of the *ligaments of the metacarpus*.

Ligaments of the Metacarpus.

The Bones of the *metacarpus* are united posteriorly with the bones of the *carpus*, and with one another. This union is made by

1. The *Articular Ligaments*; these are short and firm, serving to connect the second series of carpal bones with the posterior extremity of the metacarpal bones. According to their various situation, and the different direction of their fibres, they are called *lateral*, *straight*, *perpendicular*, &c. *ligaments* of the back of the hand.

2. The *Interosseous Ligaments of the metacarpus*. These are small, serving for the union of the anterior and posterior extremity of one metacarpal bone with the posterior and anterior extremity of another.

Ligaments of the Fingers.

Ligaments connect the phalanges of the four fingers with one another, with the bones of the *metacarpus*, but the thumb with the greater *os multangulum* of the *carpus*.

1. The *Capsular Ligaments of the phalanxes of the fingers*. These join the anterior extremities of the bones of the *metacarpus* with the

the posterior extremities of the first series of the phalanxes of the four fingers. Hence they pass from one phalanx of the fingers to another, and confine them all together.

2. The *Lateral Ligaments of the phalanxes of the fingers*, which are strong, one of them, on each side, passing from one bone to another, placed above it, to be inserted in the capsular ligament of the joint.

3. The *Capsular Ligament of the thumb*. It bounds the posterior extremity of the first phalanx of the thumb, and adheres, in its whole extent, to the *os multangulum magnum* of the *carpus*.

Of the Ligaments, which preserve the Tendons of the Muscles of the Hand in their proper Place.

They are the following ;

1. The *External Transverse Ligament of the wrist*. This strong ligament arises from the pisiform bone of the *carpus*, and the styloid process of the cubit, descends transversely on the back of the hand, and being more expanded, it terminates there on the external surface, and in the styloid process of the *radius*. It sends off some fibres, which pass over the *abductor* muscle of the thumb : and the tendons of the *extensor* muscles of the *carpus* and fingers pass between it and the bones.

2. The *Transverse Ligaments of the extensor tendons*, or the six *Vaginal Ligaments of Wrist*.
low.

bow. These short Ligaments are situated under the former, being attached not only to them, but to the bones, and cover the tendons of the *extensor* muscles, like a sheath.

3. The *Transverse Ligaments of the extensor tendons.* These are short, being extended across the back of the hand, from one tendon to another.

4. The *Internal Transverse Ligament of the Carpus.* This strong and firm ligament adheres to the four eminences, on the internal surface of the *carpus*. The tendons of the *flexor* muscles of the fingers go under this ligament.

5. The *Transverse Palmar Ligaments.* They are fastened to the heads of the metacarpal bones, pass from thence transversely, cover the *lumbricales* muscles of the *metacarpus*, and end in the metacarpal bones, and vaginal ligaments of the *flexor* tendons.

6. The *Vaginal Ligaments of the flexor tendons.* These arise from the internal transverse ligament, surround the tendons, like a sheath, and passing together with them over the palm of the hand, they go to the ends of the phalanxes of the fingers, where they end, together with the tendons of the *perforans* muscle.

7. The *Vaginal or Crucial Ligaments of the phalanxes.* These pass, in a transverse and decussating direction, over the vaginal ligaments of the *flexor* tendons, from one margin to another of the opposite side of a phalanx. Therefore, by adhering to the margins of phalanxes,

phalanxes, they keep the tendons more firmly in their place.

8. The *Accessory Ligaments of the flexor tendons*. Though these ligaments be small, they are firm. They arise from the first and second phalanxes of the fingers. They are secluded by the vaginal ligaments of the tendons, and are lost in the tendons of the *perforatus* and *perforans muscle*.

Ligaments of the Articulation of the Os Femoris with its Acetabulum.

The Two Ligaments, which connect the head of the thigh bone with the *acetabulum* of the *ossa innominata*, are the strongest and firmest of the whole body.

1. The *Capsular Ligament*, which is large, thick, and very strong, arises from the whole circumference of the margin of the *acetabulum*, and from the inferior iliac spine: it descends over the head of the *os femoris*, and is connected by a circular insertion to its whole neck and basis.

2. The *Ligamentum Teres*, or *Round Ligament*. This is strong, firm, and not perfectly round, but somewhat flattened. It arises within the articulation from the cavity of the *acetabulum*, and is inserted into a small depression, conspicuous in the head of the *os femoris*.

The Ligaments of the Articulation of the Os Femoris with the Tibia, Fibula, and Patella.

The Ligaments, by which these three bones and the intermediate femilunar cartilages are joined together, are these :

1. The *Internal Lateral Ligament*. This is broad enough. It arises from the external surface of the internal condyle of the *os femoris*, and after descending about the breadth of four fingers, is inserted into the superior part of the internal condyle of the *tibia*.

2. The *External Lateral Ligament*. This is not so broad, but it is thicker than the preceding. It arises from the external surface of the external condyle of the *os femoris*, then descends, and terminates in two less ligaments ; the larger of these is connected to the external surface of the external condyle of the *tibia* ; the less is joined superiorly to the head of the *fibula*.

3. The *Capsular Ligament*. It arises superiorly from the whole circumference of both condyles of the *os femoris* : inferiorly it is connected to the margins of the condyles of the *tibia*, and anteriorly to the whole margin of the *patella*, which serves the end of a capsular ligament in this place. This ligament is much enlarged anteriorly from the expansion of a broad *fascia*, and the tendons of adjacent muscles.

4. The

4. The *Posterior Ligament*. This arises posteriorly from the eminence of the external condyle of the *os femoris*, it descends obliquely over the capsular ligament and is inserted under the internal condyle of the *tibia*.

5. The *Great and Small Alar Ligaments*. Such are two broad ligaments resembling wings, formed of a doubling of the capsular ligament. They adhere to the sides of the *patella*, and are lost in the fat of that place.

6. The *Crucial Ligaments*. These are two strong ligaments situated within the capsular ligament, which decussate each other. The *Anterior Ligament* arises from the eminences between the superficial cavities of the condyles of the *tibia*: it ascends obliquely thence, to be implanted in the semilunar depression of the external condyle of the *os femoris*. The *posterior ligament* arises from the same eminences, ascends obliquely through a notch between both the condyles of the *os femoris*, and is affixed to the semilunar depression of the internal condyle of the *os femoris*.

7. The *Ligaments of the Semilunar Cartilages*. This is a name, which two ligaments have gotten, because they connect the semilunar cartilages, situated between the condyles of the *os femoris*, and the superficial articular depressions of the *tibia*, with one another, and with the *tibia* and *femur*.

These cartilages have ligaments, and other smaller ligaments, by means of which they are joined to the tubercles of the *tibia*, and
also

also to the ligament connecting them together.

8. The *Ligament of the Patella*. This is a strong ligament, arising from the notch in the apex of the *patella*, and, descending perpendicularly, is inserted into the anterior spine of the *tibia*.

Ligaments of the Fibula.

The Ligaments uniting the *fibula* with the *tibia*, are

1. The *Capsular Ligament of its superior extremity*. This surrounds the head of the *fibula*, and adheres to the internal condyle of the *tibia*.

2. The *Interosseous Ligament*; which is broad and strong, and extended and confined between the *tibia* and *fibula*, like the interosseous ligament of the fore-arm. It is affixed from hence to the whole posterior angle of the *tibia*, and from thence to the internal angle of the *fibula*. It is composed of strong fibres, firmly interwoven one with another; which have small interstices, here and there, for the passage of vessels. Superiorly it leaves an aperture, which is covered by muscles placed on each side: and its broad surfaces serve for the attachment of muscles going to the bottom of the foot.

3. The *Ligaments of the Inferior Extremity*. These are four, which are short, strong, and firm: two of them are situated anteriorly,

and two posteriorly. They extend obliquely from the *tibia* to the *malleolus* of the *fibula*.

Ligaments of the Tarsus.

The Ligaments which join the *astragalus* with the *tibia* and *fibula*, are

1. The *Anterior Ligament of the Fibula*. This arises from the anterior surface of the external angle, passes obliquely forward, and is inserted superiorly into the process of the *astragalus*.

2. The *Middle Ligament of the Fibula*. It arises from the top of the external angle, descends perpendicularly, and ends in the external, lateral surface of the *os calcaneum*.

3. The *Posterior Ligament of the Fibula*. This Ligament having arisen from the lowermost, and hindermost margin of the external angle, is inflected obliquely backward, and implanted in the process of the *astragalus*.

4. The *Deltoid Ligament of the Tibia*. This arises from the margin of the *tibia*, and the top of the internal angle, and terminates at the process of the *astragalus*, and the prominent circumference of the *os naviculare*.

5. The *Capsular Ligament*. It arises from the whole circumference of the articular cavity of the *tibia*, and adheres, on all sides, to the *astragalus*.

Ligaments of the Metatarsus.

The Bones of the *metatarsus* are joined to one another, and to the *tarsus* posteriorly, by the following ligaments, viz.

1. The *Capfular Ligament*, which connects the metatarsal bone of the great toe, with the cuneiform bone of the *tarsus*.

2. The *Articular Ligaments*, which connect the posterior extremity of the bones of the *metatarsus* with those of the *tarsus*. The many ligaments of this part, are variously denominated according to their situation, for example, *plantar ligaments*, *dorsal ligaments of the foot*, *lateral ligaments*, &c.

3. The *Transverse Ligaments of the back of the foot*. Such are three ligaments placed transversely upon the back of the foot, in such a manner that, one of them is always received between two bones of the *metatarsus*.

4. The *Transverse Ligaments of the bottom of the foot*. There are three of these also, which are united with the bones of the *metatarsus* on the bottom, as the former are on the back of the foot.

5. The *Interosseous Ligaments of the Metatarsus*. These three ligaments are placed like the former, but laterally between the bones of the *metatarsus*.

Ligaments of the Toes.

The Toes are connected together and with the bones of the *metatarsus*, by the following ligaments, viz.

1. The *Capsular Ligaments*, which surround the posterior extremities of the first series of the phalanxes of the toes, and the anterior extremities of the bones of the *metatarsus*; they surround also, in the same manner, the extremities of the other phalanxes; and consequently, join the phalanxes with the anterior extremities of the metatarsal bones, and with one another.

2. The *Lateral Ligaments*. These pass from the sides of the phalanxes, from one to another, and adhere every where to the articular capsules.

All these ligaments, in the same manner as in the hand, increase upon the back of the foot, from an expansion of the tendons of the *extensor* muscles; and on the bottom of the foot, from an expansion of the tendons of the *flexor* muscles.

The Ligaments which retain the Tendons of the Foot in their proper place.

As the Tendons of the muscles of the hand, so those of the back and bottom of the foot are confined by means of ligaments, lest they should be drawn from their proper place during violent motions. These Ligaments are

1. The

1. The *Vaginal Ligament of the Tibia*, which is very strong, arises from the internal angle of the lower extremity of the *tibia*, surrounds the tendons of the muscles placed there, and terminates on the external surface of the *fibula*.

2. The *Transverse or Crucial Ligament of the Tarsus*. This is double; the one arises on the external side of the foot above the external *malleolus* of the *fibula*; the other from the process of the *os calcaneum*: these two ligaments are decussated at the junction of the *tibia* and *tarsus*, the former being affixed to the internal angle, the latter to the internal surface of the *os naviculare*. The tendons of the muscles of the toes are kept in their right position by this ligament.

3. The *Ligament of the tendons of the Peronei muscles*. This arises from the anterior part of the heel, and is inserted into the external side of the eminence of the *os calcaneum*.

4. The *Lancinated Ligament*. It arises from the circumference of the internal angle, is expanded in rays, and its fibres, being separated one from another, are lost in the adjacent fat, in the proper membrane of the *abductor* muscle of the great toe, and lastly in the internal surface of the *os calcaneum*. It encloses the tendons and vessels going to the hollow of the *os calcis*, like a sheath.

5. The *Vaginal Ligament of the extensor muscle*

muscle of the great toe. It surrounds the tendon of this muscle like a sheath.

6. The *Vaginal Ligament of the proper flexor muscle of the great toe.* It includes, like a sheath, the tendon of this muscle, in the hollow of the *os calcaneum*: it is inserted into the inferior and lateral surface of this bone.

7. The *Vaginal Ligaments of the flexor tendons.* This name is given to the ligaments which resemble sheaths, and include the tendons of the *flexor* muscles, on the inferior or concave surface of the phalanxes.

8. The *Accessory Ligaments of the flexor tendons.* These are short but strong, arising, as in the fingers, from the phalanxes of the toes, and being included by the sheath of the tendons, is lost in them.

9. The *Transverse Ligaments of the extensor tendons.* By this name, small ligaments are called, which go from one tendon of these muscles to another, retaining them in the natural seat,

M Y O L O G Y.

Of the Muscles in general.

A MUSCLE is that fleshy part of a human body, by which sensible motion is performed.

Muscles are composed of fibres, of two kinds: the one, which are red, soft, irritable and sensible, called *Fleshy Fibres*; the other, which are smaller, firmer, stronger, and of a white and silver-like colour. These latter fibres, when collected into a smaller and round bundle, come under the name of *Tendons*; when expanded upon a wide superficies, they are called *Aponeurotic Expansions* ⁽¹⁴⁸⁾.

Every muscle is divided into three parts; its middle or belly, which always consists of fleshy fibres, its beginning and its end. The beginning and end of a muscle are generally tendinous; and the former is called a *fixed point*; the latter a *moveable point*, or simply, a *tendon* ⁽¹⁴⁹⁾.

Muscles

⁽¹⁴⁸⁾ A Tendon is already described (Note 146.). Perhaps there is no unequivocal sign of muscularity, except voluntary motion. "*Filorum rubrorum fasciculi*," (Haller, *Prim. Lin. Phys.* § 394.) is a bad definition: for the ultimate fibres of muscles are not red, but white (Note 152.).

⁽¹⁴⁹⁾ The *Origin* of a muscle is that part which arises nearest to the trunk of the body, and which arises from

Muscles acquire various names, from their size, figure, situation, direction, composition, use, and from the parts to which they are attached; hence, they are called, *Great, Middle, Small, Broad, Triangular, Round, Pectoral, Brachial, Oblique, Transverse, Tricipites, Biventre, Pronatores, Flexores, Cleidomastoid, Coracoid, &c.*

There are found in all muscles, soft, long, slender fibres, collected into bundles by the vast mass of cellular texture which surrounds them. These little bundles are joined together, so as to make larger bundles, by means of the same cellular membrane, partly filled with fat. These bundles are separated from one another by membranous partitions, till many similar bundles, covered with cellular membrane, constitute a *muscle*. The membrane, which covers muscles, and is simple, smooth, fat, and produced of cellular texture, is called the *cellular coat of a muscle* (¹⁵⁰): but the cellular texture, which encloses tendons,

the most stable part, towards which the contraction is made. The origin of a muscle is also called its *Head*, and its *Centre of Motion* (Douglas, *Myog. Comp.* Introd.).

The *Insertion* of a muscle is more remote from the trunk of the body; it is smaller; it is implanted into the part to be moved. It is also called the *Tail*, or *End of a muscle*, or simply, its tendon.

The *Belly*, or *Middle* of a muscle, is that part which swells when a muscle acts; it lies between the Origin and Insertion (Winslow, *Exp. Anat.*).

(¹⁵⁰) The *cellular coat of a muscle*, was called by the ancients *membrana muscularum communis*. The covering however of muscles, and muscular fibres, is nothing but cellular membrane (Morgagni, *Adv. Anat.* II, *Animad.* VI. p. 17.) and

and is very like the cellular coat of muscles, is called their *sheath*.

The fibres, of which muscles are composed, are longitudinal, semicircular, oblique or transverse. If they all go in the same direction, the muscle is called *simple*; but if they go in various directions, in the same muscles, then it is called *compound* ⁽¹⁵¹⁾. Moreover, all the large muscles, which are formed of less, are in general compound muscles.

All muscles have *nerves* distributed throughout their fleshy fibres; they have *arteries* and *veins* likewise propagated plentifully among their fibres, through the cellular coat above-mentioned, where they disappear in the form of a most delicate network, and impart the red colour to muscles. The Tendons of muscles have only lymphatic vessels ⁽¹⁵²⁾.

The

⁽¹⁵¹⁾ Besides the *simple*, or *rectilinear* muscle, there is the *radiated* muscle, in which the fibres go like rays. A muscle is called *penniform*, when its fibres are disposed like the plume of a feather; *compound penniform*, when two simple penniform muscles are contiguous.

Muscles that concur in producing the same action, are called *congeneres*: but those that act contrary to each other are called *antagonistae*, or *extensores* and *flexores*. If there were not *flexores* as well as *extensores*, the limbs must always remain extended.

⁽¹⁵²⁾ The redness of a muscle depends on the blood-vessels in its cellular membrane. The muscular fibres of the arteries, and of the stomach and intestines, and of other parts are naturally pale; and the reddest muscle becomes pale also when washed, and freed from its red blood.

The arteries, veins, lymphatics, and nerves of muscles run contiguous to one another.

How

The *Use* of muscles is, to perform the motions of the body. But the motion of most muscles is under the influence of the mind; though the motion of some depends on a power inherent in them: for example, the Heart, the Intestines, &c. (¹⁵³).

Muscles

How came Leber to aver "*Tendines vero vasis solum gaudent lymphaticis?*" Perhaps he only meant to say that red blood is not circulated through them.

(¹⁵³) All the motions of a human body are not performed by muscles; for there are some parts, not muscular, that seem to be moved only in consequence of the force of the blood propelled into them. Such are the *corpora cavernosa* of man, and the *clitoris* and nipple of woman.

The form of the body, and the elegance of gait, depend on muscles. It is by muscles that we express our thoughts and sensations.

All that is known of the fabric of muscles is already mentioned. Whether muscles be continuations of nerves, or not, is a question of easy solution. 1. Muscles are strong and tough: nerves are pulpy and soft. 2. Muscles contract, when stimulated: nerves are not contractible. 3. Is it rational to imagine that a large muscle can be formed of a small nerve; the fibres of which run parallel to one another, and do not divide like the blood-vessels? 4. Dividing the spinal marrow, or sciatic nerves of a frog produced no sensible alteration in the muscles of the thigh and leg of a frog more than a year afterwards. Now, certainly if muscles arose from the extremities of nerves, such a division should have caused them to shrink (Obs. on the Struct. and Func. of the nervous system, &c. by Alex. Monro, M. D. &c.).

The actions of the human body are commonly distinguished into *vital*, *natural* and *animal*; the first comprehending the motion of the lungs, and heart and arteries; the second comprehending digestion, chylicification, nutrition, secretion, &c. and the last comprehending all the senses, and voluntary motions. But this distinction is certainly useless; for all the motions of animals are equally intitled to the name of *natural motions*: all of them
are

Muscles of the Head.

The Muscles of the head are situated either immediately under the common integuments ;
or

are effects of life, and are equally *vital*, and equally *animal*.

A better division of animal motions is perhaps into *voluntary* and *involuntary*: the former comprehending such as proceed from an immediate exertion of the active powers of the will ; and the latter comprehending such as are performed by the organs, seemingly of their own accord, without any attention of the mind, or consciousness of its active power.

The involuntary motions of animals are, some of them under the controul of the will ; at least, though not ordinarily directed by it, yet they are subject to it. For example, the intercostal muscles, the abdominal muscles, and the diaphragm, which ordinarily act, without our being conscious of their acting ; but which may be prevented from acting at all, as often as we please. Dr. Whytt calls these *Mixed Motions* ; and comprehends both them, and those that are performed, at all times, without any attention of the mind, under the general denomination of *Spontaneous Motions*.

When a muscle acts, it becomes shorter and thicker ; both its *origin* and *insertion* are drawn towards its *middle*. The *sphincter* muscles are always in action ; and so likewise are *antagonist* muscles, even when they seem at rest. When two *antagonist* muscles move with equal force, the part which they are designed to move, remains at rest ; but if one of the *antagonist* muscles remains at rest, while the other acts, the part is moved towards the *centre of motion* of the muscle. All this is evident in the diseases called *Tetanus* and *Opisthotonos* and *Emprosthotonos*. All the muscles of live animals are constantly endeavouring to shorten themselves.

When a muscle is divided, it contracts. If a muscle be stretched to a certain extent, it contracts and endeavours to acquire its former dimensions, as soon as the stretching cause is removed. This takes place in the dead body ;

or are to be referred to the eyes, ears, nose, mouth, lips, lower jaw, *os hyoides*, tongue, pharynx,

body; it takes place in muscles cut out of the body; it takes place in parts that are not muscular. This power is called by Haller *Vis Mortua* (*Prim. Lin. Phys.* § 400.): others have called it *Vis Elastica*. It is greater in living than in dead bodies, and is called *Tone*.

When a muscle is wounded, touched, or otherwise irritated, it contracts, independent of the will of the animal that is the subject of the experiment, and without its feeling pain. This property of a muscle is called by Haller, *Vis Insita*. It is a power peculiar to, and inherent in the muscles; according to Haller, exclusively of the nerves (Weber, *Comment. de initiis ac progressibus doctrinae irritabilitatis. Halae, 1783.*).

Another power of the muscles is that by which they act, when excited by the nerves. Whytt called it *Vis Nervosa*, or the *power or influence of the nerves*. Finding that the *vis insita* of Haller is excited and destroyed by the same means as the *vis nervosa*; finding that by destroying the nerve going to a muscle, the irritability, or *vis insita*, of the muscle perishes, he concluded that the irritability depends upon the sensibility, and reasoned somewhat after this manner:—when a *stimulus* is applied to a muscle, it excites an ungrateful sensation in it, which sensation is carried by the nerves to the mind: the mind, using the same messengers, sends back its mandates to the muscle, which by contracting endeavours to rid itself of the *stimulus*.

Now to me, this doctrine of the celebrated Whytt seems extremely erroneous; for it supposes that there is sensation, without the consciousness of the mind; it supposes sensation in a muscle, when separated from the rest of the body.—The disciples of Whytt endeavour to account for the contraction, which remains in parts when separated from the body, by assigning it to the *vis nervosa* still abiding in them, and keeping them alive; but granting the truth of this, it militates not against the *vis insita* of Haller.

Haller never denied that the nerves going to muscles are capable of exciting those muscles, whether detached

pharynx, soft palate, and the top of the *aspera arteria*; or lastly, they are intended for the motion of the head itself.

Of

from the body, or not. Haller every where allows that irritability and sensibility are increased and diminished by the same powers. But parts that are irritable are not consequently sensible; for the heart is not sensible, though it is extremely irritable; and the intestines are less sensible than the stomach, but far more irritable.

Again, the nerves going to the heart are derived from the intercostal nerve and the *par vagum*: and if these be divided, or tied, on both sides, the animal does not immediately die, neither did the heart cease to contract in seven or eight minutes afterwards (Marherr, in Boerh. § 189.). Even Whytt allows that motion may be excited in paralytic limbs by electricity (Physiol. Essays.).

Animals, as the *polypus*, and plants, in which no nerves have been discovered, are extremely irritable (Haller, *Elem. Phys. Sect. 2. Ap. T. IV.*).

Lastly, Haller never denied that the contraction of a muscle is greater, when the *stimulus* is applied to the nerve going into that muscle. For, it is plain, that as the nerve is disseminated throughout the muscle; and, as the internal parts are frequently more irritable than the external, it is plain, I say, that more contraction shall ensue by exciting a muscle by the *vis nervosa*, than by exciting it by other means.

Albinus remarks—" *experimenta indicant, integritatem nervi requiri, ut aptus sit musculus qui secundum naturam se moveat: ostendunt, nervo stimulado fibras carneas in convulsiones agi. An vero ostendunt, nervorum potestate moveri? Excusatam velim incredulitatem meam (Annot. Acad. Lib. I. Cap. XII. p. 49.)*."

Professor Blumenbach, in his Physiological Institutes, enumerates five vital powers; the three following of which he calls *common*: viz. 1. *Contractility*, which is a property of the cellular membrane, and may be named *Vis cellulosa*, 2. *Irritabilitas*, which is as Haller describes it, and from its being a property of muscles, he names *Vis musculosa*, 3. *Sensibility*, which is a property of the nerves by which they communicate impressions to the brain, he names

Vis

Of the Muscles of the Cranium.

These are the two *Frontales* Muscles, and the two *Occipitales*. Some authors describe them

Vis nervea. A fourth power, he calls *Vita propria*, comprehending under it those powers which cannot be referred to either of the former three classes of common powers; as the powers of the *Viscera*, which have such singular motions that they cannot be derived from either of the former classes, but must be referred to some *Vita propria*. His examples are taken from the motions of the *Iris*, the erection of the *Papilla*, the motion of the *Fimbriae* of the Fallopian tubes, the action of the *Placenta*, and of the *Uterus* in time of labour, the descent of the testicles, and perhaps secretion. The fifth, and last power, he calls *Nifus formativus*: which, he says, is the efficient cause of the whole business of generation (taken in the most extensive sense, and comprehending both nutrition and reproduction as its modifications). It ought to be considered, he says, as that which causes the genital or nutritious matter received in the proper place, and brought to maturity, to take on its destined form, and to pass into those parts, which are endowed with the common vital powers and *Vita propria* (*Inst. Phys. Sect. IV.*).

Speaking of the distinction of motion into voluntary and involuntary, Professor Blumenbach says, it is encumbered with many difficulties, so that it is hardly possible to determine the limits of each. He thinks the only involuntary motions are the spasms of the *Uterus* during labour. For he refers to the case told by Cheyne, in his *Treatise on Nervous Diseases*, in which the beating of the heart was under the controul of the will: he says, the motion of the stomach is voluntary, as rumination shows in general, and as he says in a ruminating man: he says he is credibly informed of a man who could contract his iris in a dark place, and lessen his pupil, as often as he chose; and he says he knew men who could at pleasure bring on a contraction of the skin like that occasioned by the idea of certain ungrateful sensations (*Sect. XXIII.*).

them both under the common name of *Musculus Epicranius*, or *Digastricus Cranii*, because they are connected to each other by an aponeurotic expansion; but we shall consider the *Frontales* and the *Occipitales* separately (¹³⁴).

The *Frontales* are two thin muscles, one of which arises by a fleshy beginning on each side, near the middle of the orbital margin, from its interior part. They are united to each other,
at

Whether a muscle be *stimulated* through the *medium* of the nerves by the will, or by any foreign body applied directly to it, or by its being stretched beyond its usual length, or otherwise; it contracts, and its contraction is greater or less, in proportion as the *stimulus* applied is greater or less.

The contraction of muscles is different according to the purpose to be served by their contraction. Thus, the heart contracts with a jerk; but the urinary bladder contracts slowly and uniformly. Puncture a muscle, and its fibres vibrate. The abdominal muscles act slowly in expelling the contents of the *rectum*, but violently in vomiting.

Relaxation generally succeeds the contraction of muscles, and alternates with it, even though the *stimulus* be continually applied. And the alternate contractions and relaxations of muscles continue frequently a long time, after the *stimulus* that first excited them is removed. But muscles obedient to the will continue contracted or relaxed as long as the will continues to determine the influence of the nerves into their fibres.

Some muscles continue in a state of contraction as long as the *stimulus* continues to act. Such are the orbicular muscle of the *uvea* and the muscles of the internal ear.

These are the chief of the *phenomena* of muscles. Their causes are beyond the sphere of our comprehension.

(¹³⁴) Cowper and Albinus were among those who accounted the *frontales* and *occipitales* as one muscle. Cowper called them *Digastricus* (*Myot. in fol. p. 16.*); and Al-

at their origin, and with the muscles of the eye-brows, the *orbiculares palpebrarum*, and those of the nose, by means of some fibres. Hence they ascend obliquely outwards to the coronal future, where they become, for the most part, tendinous. They adhere firmly to the membrane stretched over the *ossa synipitis*, and to the tendinous expansion of the *Occipitales* muscles; constituting with the latter what is called *Galericulum Aponeuroticum* ⁽¹⁵⁵⁾.

The *Occipitales* Muscles have their name from the bone they cover. They arise on each side from the external spine of the *os occipitis*, and pass transversely towards the mastoid process. They are thin and tendinous at their beginning, and ascend obliquely. Their extent is nearly equal to the breadth of two fingers. They are terminated in a broad aponeurotic expansion, uniting with the broad tendon of the frontal muscles, and forming the *Galericulum Aponeuroticum* before-mentioned, which adheres very firmly to the skin, but very laxly to the *pericranium*: so that the skin is easily moved with the *galericulum*. It is extended on both sides to the neck, and covers the muscles placed there ⁽¹⁵⁶⁾.

The

Albinus *Epicranius* (*Historia Musc.*). Douglas described both *Occipitales* and *Frontales* muscles, under the name of *Occipito-frontalis* (*Myol. Comp.*): and so also did Innis (A Short Description of the Human Muscles, &c.). But Leber has followed the example of Heister (*Comp. Anat.*).

⁽¹⁵⁵⁾ The Antagonists of the *Frontales* Muscles, according to Heister, are the *Orbiculares Palpebrarum* (*Comp. Anat.*): but, according to Douglas, the *Corrugator* is the antagonist of the *occipito-frontalis*.

⁽¹⁵⁶⁾ These occipital muscles, according to Morgagni,
are

The *Uſe* of theſe four muſcles is, to wrinkle the forehead, alſo to ſmoothen it; to elevate the eye-brows, and to draw the ſkin reciprocally backwards and forwards.

Of the Muſcles of the Eye-Brows.

The *M. Corrugator Superciliorum* is ſituated behind the inferior part of the frontal muſcle. It ariſes near the connection of the *os frontis* and *os naſi*; then ſends off fibres upwards and outwards in the direction of the orbital arch; and is loſt in the adjacent muſcles, and common integuments of the eye lids (¹⁵⁷).

Its *Uſe*. With the correſponding muſcle, it brings the eye brows nearer together, and contracts the ſkin within the eye brows into longitudinal folds.

Of the Muſcles of the Eye Lids.

There belong to each *Eye Lid* three muſcles, viz.

1. The *Orbicularis Palpebrarum*.
2. The *Levator Palpebrae Superioris*.
3. The *Depreſſor Palpebrae Inferioris*.

are ſometimes wanting; and are ſometimes ſo thin as to be ſcarcely diſtinguiſhable. Sometimes, however, they are large, and appear as if divided into two: hence Santorinus accounted the occipital muſcle of each ſide double (*Obſ. Anat. p. 8 & 9.*).

(¹⁵⁷) Volcherus Coiter was, I believe, the firſt who deſcribed this muſcle: hence it is called by Douglas, and others, *Corrugator Coiteri*, or *Muſculus Frontalis Verus*. To Cowper and Heiſter, this muſcle ſeemed to be only an oblique elongation of the *frontales* muſcles; but to Santorinus it ſeemed as a part of the *orbicularis*.

The *Orbicularis Palpebrarum* is thin and broad. Its fibres, which are fleshy, adhere to the whole circumference of the orbit; but become thinner, and broader near the zygomatic arch. They are thicker in the superior eye lid, and more compacted together; and are, lastly, interwoven with the fibres of the frontal muscle. Moreover the fibres of this muscle are decussated in the internal and external *canthus*, and send a small tendon into the internal angle of the eye, which is connected to the nasal process of the upper jaw ⁽¹⁵⁸⁾.

Its *Use*. It shuts the eye lids; and hence it is that some call it the *Sphincter Oculi*.

The *Levator Palpebrae Superioris* is the thinnest of all. It begins by a small tendon in the bottom of the orbit, near the optic *foramen*, and passes forwards: it becomes broader in its course, and adheres by means of a broader tendon to the cartilage of the upper eye lid ⁽¹⁵⁹⁾.

Its

⁽¹⁵⁸⁾ The *Ciliaris* muscle described by Riolan (p. 308.) is nothing more than the thicker part of this muscle, covering the *cilia*, or *tarfi*.

The tendon of this muscle may be felt in the internal *canthus*. It lies over the lacrymal sac: and it is divided in the operation for *fistula lacrymalis*. A small fleshy bundle of fibres running down from the outer and inferior part of this muscle, over the *zygomaticus minor* to the *Levator Labii superioris* and *Alae Nasi*, is mentioned by Douglas and Innis.

⁽¹⁵⁹⁾ *Aperiens palpebram rectus*, of Fallopius (*Obs. Anat.* p. 61.), and Douglas. The action of this muscle was formerly assigned to the *Orbicularis Palpebrarum*: but when Fallopius had learnt from Oribasius that the *unguis* frequently exfoliates in *fistula lacrymalis*, and that the eye could, nevertheless, be opened at pleasure; he

sought

Its name is expressive of its Use.

The *Depressor Palpebrae Inferioris* arises sometimes from the *os zygomaticum*, but oftener from the fibres of the *platysma myoides*, which ascend over the cheeks. It ascends obliquely, and is connected to the *tarsus* of the under eye lid.

Its Use is evident from its name.

Of the Muscles of the Ball of the Eye.

Six muscles are destined for the motion of the ball of the eye; two of which are called *Obliqui*, and the other four *Recti*.

1. *Obliquus Superior*, or *Magnus*.
2. *Obliquus Inferior*, or *Parvus*.
3. *Rectus Superior*.
4. *Rectus Inferior*.
5. *Rectus Internus*.
6. *Rectus Externus*.

1. The *Obliquus Superior*, or *Magnus*, or *Trochlearis*, arises by a small tendon, near the internal optic foramen, between the *rectus superior* and *internus*; from thence it passes forwards, and goes by a very small, long tendon through the *trochlea*, formed of a canal in the orbital process of the *os frontis*, at the inner angle of the orbit, and a cartilage that is hollowed in the middle. It is fastened in this place by means of a double ligament; and being come out of the *trochlea*, it is bent backwards, and inserted into the posterior sur-

sought after the cause of it, and found and described this muscle (Douglas, Descrip. of the Muscles. *Versio Latina*, cum notis Joan. Fred. Schreiber.).

face of the ball of the eye, near the *rectus externus* muscle.

Its *Use*. It draws the ball of the eye downwards and inwards.

2. The *Obliquus Inferior*, or *Parvus*, arises in a small depression, situated in the nasal process of the superior maxillary bone, towards the margin of the orbit, near the orifice of the lacrymal duct: from thence it passes round the ball of the eye, and is inserted into it, by means of its broader tendon on the posterior and lateral part, behind the *rectus externus*.

Its *Use*. It moves the eye-ball inwards and downwards at the same time.

The *Recti* Muscles of the ball of the eye have gotten names, not only from their situation, but from their use also: as

1. *Rectus Superior*, or *Attollens*, or *Superbus* ⁽¹⁶⁰⁾.

2. ——— *Inferior*, or *Deprimens*, or *Humilis*.

3. ——— *Internus*, or *Adducens bulbum*, or *Bibitorius*.

⁽¹⁶⁰⁾ Between this muscle and the *Levator Palpebrae superioris*, there is a quantity of adipose membrane.

Mr. Hunter properly observes, that—"for distinct vision, the object must be fixed respecting the pupil of the eye, and not in the least allowed to move over its surface. To prevent any progressive motion of the object over the retina of the eye, either from the motion of the object itself, or of the head in some of the motions of that part, the straight muscles (*Recti*) are provided, as has been explained; but the effects which would arise from some other motion of the head, as from shoulder to shoulder, cannot be corrected by the action of the straight muscles, therefore the oblique muscles (*Obliqui*) are provided (Obs. on Certain Parts of the Animal Oeconomy. p. 209.)."

4. *Rectus*

4. *Rectus Externus*, or *Abducens bulbum*, or *Indignatorius*.

The Four Muscles now mentioned, arise by small tendons near the *foramen opticum*, from the *periorbit*, or *periosteum* covering the orbit; pass thence fleshy, in a straight direction, and are inserted into the *tunica sclerotica* of the eye, by the intervention of broad tendons.

Their *Use* is manifest from their description.

The Muscles of the Ear.

The Muscles of the Ear are distinguished into *External* and *Internal*: the *External* are again divided into two classes.

The three referred to the external ear, are connected with contiguous parts: viz.

1. The *Superior* and *External Auricular*.
2. The *Anterior* and *External Auricular*.
3. The *Posterior* and *External Auricular*.

The Five others, which though small are always present, belong to the cartilages of the ear: viz.

1. The *Tragicus*.
2. The *Antitragicus*.
3. The *Transversus Auriculae*.
4. The *Major Helicis*.
5. The *Minor Helicis*.

The *Muscles of the Internal Ear* are four in number, and those are very small: viz.

1. The *Musculus Mallei Externus*,
2. The *Laxator Tympani*,
3. The *Tensor Tympani*,
4. The *Stapedius*.

Of the Muscles of the External Ear.

1. The *Superior External Auricular*, or *Attollens*, is composed of very small fleshy fibres, which arise from the aponeurotic expansion of the frontal muscles, and of the occipital muscles near the temporal region. These fibres afterwards pass over the aponeurotic expansion of the temporal muscle, and are inserted into the *helix*, partly externally and partly internally, near the opening of the ear, by means of a tendon (¹⁶¹).

Its *Use* is evident from its name.

2. The *Anterior External Auricular*, which is less than the rest, arises at the base of the zygomatic process from the tendinous membrane of the temporal muscle, it runs almost transversely backwards, and adheres to a part contiguous to the *concha* at the beginning of the external *helix*.

As to its *Use*, it seems to stiffen this part of the *concha*.

3. The *Posterior External Auricular*, or *Retrahens*, is situated almost transversely. It

(¹⁶¹) The number of the external muscles of the ear is uncertain. The ancients made no mention of them at all; and Fallopius, who first described them and enumerated three, confessed that they are not always present (*Obs. Anat.*). Du Verney described only two muscles of the external ear (*Traët. de Auditu.*). Valsalva described one *superior* muscle, three *posteriores*, and one *anterior* detected by himself (*De Aure Hum. Traët. Cap. I. § 6.*). If one may confide in Heister, the number of these muscles is different in almost every subject (*Comp. Anat.*).

is often double, and stronger than the two preceding. It arises from the aponeurotic expansion of the cervical muscles at the mastoid apophyses of the *ossa temporum*, passes transversely forwards, and is fixed in the convex part of the *concha*.

Its *Use* is to draw back the *concha*.

Of the Muscles of the Cartilages of the Ear.

1. The *Tragicus*, which is small, and almost square, arises from the margin of the *tragus*, and terminates in the *tragus* anteriorly and externally.

The *Use* of the *Tragicus* muscle is to stiffen the *tragus*, and perhaps to dilate, in some degree, the opening of the ear (¹⁶²).

2. The *Antitragicus*, which arises from the root of the interior *helix*, and is inserted inferiorly at the top of the *antitragus*.

Its *Use* is to dilate the mouth of the *concha*.

3. The *Transversus auriculæ*; it arises from the upper part of the *concha*, runs transversely backwards, and is fixed to the interior *helix*.

4. The *Major Helicis exterioris*; this muscle is narrow, and oblong; it arises from the

(¹⁶²) Marsh says the *tragicus* muscle is hardly able to dilate the *concha* (*Prael. in Boerb. Inst. Med.* § 550.); and Heister says that the muscles ascribed by Valsalva to the *tragus* and *antitragus*, and by Santorinus and Douglas to the *helix*, *concha*, and *meatus auditorius*, are, in his opinion, only muscular membranes, and not true muscles, because they have seldom any fleshy fibres, or perform any manifest motion (*Comp. Anat.*).

fore part of the acute cartilaginous process of the exterior *belix*, ascends in the course of this *belix*, and is implanted in it ⁽¹⁶³⁾.

5. The *Minor Helicis exterioris*; it arises from the bottom of the exterior *belix*, ascends externally according to the flexure of this *belix*, and is inserted into its margin ⁽¹⁶⁴⁾.

Their Use. The muscles now mentioned, seem to stretch the two cartilages of the ear, that sounds, scarcely audible, may be perceived the more distinctly,

The Muscles of the Internal Ear.

1. The *Externus Mallei*; it arises from the spinous process of the *os sphœnoides* projecting between the squamous and petrous processes of the temporal bone; it passes through a small fissure of the articular cavity of the temporal bone, and is connected to the longest process of the *malleus*. Many doubt, whether it be a real muscle, because it cannot be distinguished from the red spongy membrane ⁽¹⁶⁵⁾.

2. *Laxator Tympani*; this is a very small, thin muscle, arising superiorly from the edge

⁽¹⁶³⁾ The *Major Helicis* muscle is often wanting (Albinus, *Annot. cad. L. VI. Tab. IV.*).

⁽¹⁶⁴⁾ The *Minor Helicis* muscle, though described by Albinus, Haller, and a few others, has not been seen by many eminent anatomists (Marherr.).

⁽¹⁶⁵⁾ Albinus and Du Verney, call it also *Externus Mallei*. Innis enumerates only three muscles of the internal ear, and gives the name of *Laxator Tympani* to this, comprehending under it both the *Externus Mallei* and the *Laxator Tympani* of Leber and other anatomists.

of the *membrana tympani*, at the end of the *meatus auditorius externus*, where the *membrana tympani* is fixed. It ends by a very small tendon at the *manubrium mallei* near its smaller process.

Its *Use* is, to draw the *manubrium mallei* backwards and outwards; and, of consequence, to relax the *membrana tympani* after its being stretched. It is doubted by some celebrated anatomists whether this be a real muscle, or not.

3. The *Tensor Tympani* adheres, by means of a very small tendon, to a process of the *os sphenoides* between the canal of the internal carotid, and the orifice for the artery of the *dura mater*: it runs in its proper furrow in the Eustachian tube, and is there covered by a membranous sheath, which together with the furrow forms an entire canal. It then becomes gradually smaller; and is connected, at the end of the canal, to the beginning of the *manubrium mallei*, which is turned downwards and outwards ⁽¹⁶⁶⁾.

Its *Use*. When this muscle acts, it draws the *manubrium mallei*, and with it the *membrana tympani* inwards, and consequently stretches it.

4. The *M. Stapedius* is small, and inclosed in a cartilaginous cone. From this muscle

⁽¹⁶⁶⁾ The *Tensor Tympani* is the *Internus Auris* of Douglas.

there

there goes a tendon forwards, to unite with the head of the *stapes* under the *incus* (¹⁶⁷).

The Muscles of the Nose.

To the Nose three pair of muscles are proper; three muscles being on each side; viz.

1. The *Levator Alae Nasi, Labiique superioris*;

2. The *Constrictor, or Compressor Nasi*;

3. The *Depressor Alae Nasi*;

And some refer to these,

4. The *Nalis Labii superioris*.

1. The *Levator Alae Nasi, Labiique superioris* arises, by a double tendon, from the nasal process of the superior maxillary bone: it descends on the sides of the nose, and is inserted by its interior part into the *pinnae*, and by its exterior into the upper lip and *sphincter oris*.

Its *Use*. It dilates the nostrils, and raises the upper lip (¹⁶⁸).

(¹⁶⁷) *Stapidaeus* of Douglas. When this muscle acts, it elevates the *stapes*.

(¹⁶⁸) Douglas called this muscle *Elevator Labii superioris proprius*. Winslow called that part which arises from the external orbital process of the maxillary bone, *Incisivus lateralis*. It is this portion that draws the upper lip upwards and outwards. The portion, that arises from the nasal process, at the *inner canthus*, Winslow called *Pyramidalis* (*Exp. Anat.*). But see the *Levator proprius Labii superioris*, among the muscles of the mouth and lips.

2. The

2. The *Constrictor*, or *Compressor Nasi*, is a small muscle arising, by a narrow beginning, from an eminence of the superior maxillary bone: it runs, and grows broader as it spreads over the sides of the nose. It unites, in part, with its fellow on the opposite side, and, in part, vanishes in the *pinnae*.

Its *Use*. When this pair of muscles act, the *pinnae* are pressed towards the *septum*, so that the nostrils are lessened ⁽¹⁶⁹⁾.

3. The *Depressor Alae Nasi* arises from the superior maxillary bone, and the *alveoli* of the superior *incisores*, and canine teeth: it descends and grows broad, and is implanted in the *septum* and lowest part of the *pinnae narium*.

Its *Use* is, to draw the nose downwards, and to stiffen it in some degree ⁽¹⁷⁰⁾.

4. The *Nasalis Labii superioris* is described among the muscles of the mouth and lips.

Its *Use* is to draw the tip, and *septum narium* downwards.

The Muscles of the Mouth and Lips.

To the Lips we assign twelve muscles, of which the eighth and eleventh are simple, all the rest are double.

1. The *Levator Labii superioris, Alaeque Nasi*.

⁽¹⁶⁹⁾ Douglas called it *Rinaeus*, or *Nasalis*.

⁽¹⁷⁰⁾ It is the *Depressor Labii superioris proprius* of Douglas; the *Incisivus medius* of Winslow, and the *Depressor Labii superioris Alaeque Nasi* of Innis. San.

2. The

2. The *Levator Labii superioris proprius*.
3. ———— *Anguli Oris*.
4. The *Zygomaticus major*.
5. The ———— *minor*.
6. The *Buccinator*.
7. The *Nasalis Labii superioris*.
8. The *Orbicularis Labiorum*.
9. The *Depressor Anguli Oris*, or *Triangularis*.
10. The ———— *Labii inferioris*, or *Quadratus*.
11. The *Levator Menti*.
12. The *Latissimus Colli*, or *Platysma-myoides*.

1. The *Levator Labii superioris*, *Alaeque Nasi* is described among the muscles of the nose.

Its *Use* is evident from its name.

2. The *Levator proprius Labii superioris*, or *Incisivus* arises, by a very small tendon, from the superior maxillary bone, at the infra-orbital margin: its fleshy fibres run upwards and obliquely inwards to the lip, and are there mixed with the fibres of the *orbicularis Labiorum*.

3. The *Levator Anguli Oris*, or *Caninus*, composed of slender fibres, arises from the upper jaw, by a very short but double tendon, immediately below the *foramen orbitale anterius*: it passes from thence downwards to the angle of the mouth, and is finally inserted into the *orbicularis labiorum* ⁽¹⁷¹⁾.

⁽¹⁷¹⁾ Douglas calls it *Elevator Labiorum communis*: Winslow *Caninus*.

The *Use* of this muscle, as well as of the preceding, is evident from their denominations.

4. The *Zygomaticus major* is long and small; it arises from that part of the Zygomatic bone which is connected with the Zygomatic process of the temporal bone. The fibres of this muscle, collected, as it were, into a bundle, descend obliquely inwards, and are crossed by the fibres of the *elevator anguli oris*, and *sphincter labiorum*, in which they disappear.

Its *Use*. When this muscle and its fellow, on the opposite side, act at the same time, the angles of the mouth are drawn from each other. When only one acts, the angle of the mouth, and the cheek are drawn laterally upwards (¹⁷²).

5. The *Zygomaticus minor*, if it be present, (for it is often wanting,) is the smallest muscle of the mouth and lips: it arises directly under the former, and is turned rather more inwards: it descends and ends in the *sphincter labiorum*.

Its *Use* is the same as that of the former.

6. The *Buccinator* arises from the *alveoli* of the superior *molars*, and descends to the *alveoli* of the inferior *molars*. The fleshy fibres of this muscle are joined together, and anteriorly with the *sphincter labiorum* in the angle of the mouth.

(¹⁷²) This muscle, in its oblique descent, is often divided into two (*Eustac. Tab. XXIX. XXXV.*). It acts both in laughing and crying.

Its

Its Use. In chewing, it pushes the food between the teeth; in blowing musical instruments, it both retains and expels wind, according to the will of the musician. Moreover, it may be observed concerning this muscle, that it is perforated in its middle by the salival duct of Steno⁽¹⁷³⁾.

The *Nasalis Labii superioris* is composed of a few fleshy fibres arising from the tip of the nose; and the *septum* contiguous to it, descending to the upper lip, running outwards to the angle of the mouth, and disappearing in the *sphincter labiorum*⁽¹⁷⁴⁾.

Its Use. When it acts, it either draws the *septum narium* and apex of the nose downwards, or it contracts the angles of the mouth, and corrugates the upper lip.

8. The *Orbicularis Labiorum*, or *Sphincter Oris*, is broad and sufficiently thick, especially at the angles of the lips: it measures the whole circumference of the mouth, in such a manner that the fibres of the upper lip are mixed with those of the under, in the angles of the mouth. For this reason it is, that this muscle is divided into the *superior* and *inferior* by some authors, each being of a semicircular figure. It is fixed to no bone, but

⁽¹⁷³⁾ When this muscle acts it enlarges the parotid gland.

⁽¹⁷⁴⁾ This muscle, which is described by Albinus, is said by Innis to be only some fibres of the *orbicularis oris* connected to the *septum narium* (Descrip. of the *Orbicularis oris*.).

is strengthened by the fibres of neighbouring muscles running into it ⁽¹⁷⁵⁾.

Its Use is to contract the mouth and corrugate the lips.

9. The *Depressor Anguli Oris* is small and triangular, and hence it is called by some *Triangularis Labiorum*. It arises by a fleshy beginning from the margin of the lower jaw, its fibres being rather expanded on the side of the chin; but they are contracted, as they ascend, into a narrow bundle, and are intersected by the fibres of the *sphincter labiorum* at the angle of the mouth ⁽¹⁷⁶⁾.

10. The *Depressor Labii inferioris* is a small muscle of the same breadth from beginning to end: hence, from its having four corners, it was called by some authors *Quadratus menti*. It arises from the chin, and is inserted into

⁽¹⁷⁵⁾ Douglas called it *Sphincter Labiorum*. Winslow is among the authors referred to by Leber, who considered the *orbicularis labiorum* as two distinct muscles. His words are,—“ when we examine carefully the angles of the lips, we find that the fibres of the upper lip intersect those of the under lip, and we easily distinguish the muscular arch of one lip from that of the other; and for this reason I divide this muscle into two, and I call them either by the common name of *Semi-Orbicularis*, or I call one of them *Semi-Orbicularis superior*, and the other *Semi-Orbicularis inferior*; but the name of *Semi-Ovales* would be still more proper (*Exp. Anat. Vol. II. Sect. X. § 553.*)” A Hare-Lip is a natural division of the superior part of this muscle.

⁽¹⁷⁶⁾ Douglas called it *Depressor Labiorum communis*. Winslow called it *Triangularis*. But Schreiber observes that, if it be named from its figure, he would call it *Lunatus* (*Douglas Versio Latina cum notis.*).

the

the middle of the lower lip, in which it is confounded with the *sphincter labiorum* and the *depressor anguli oris* ⁽¹⁷⁷⁾.

11. The *Levator Menti*, or *Incisivus inferior*, arises from an excavation in the under jaw, above the chin, immediately below the *incisores*: it descends and ends in the skin of the chin ⁽¹⁷⁸⁾.

Its Use is to raise the chin and lower lip.

12. The *Latissimus Colli*, or *Platysma-Myoides*, and its fellow, cover the whole anterior, and lateral parts of the neck. This broad thin muscle arises from the clavicle and *humerus*, passes obliquely over the neck to the lips, and almost to the ears, and ends in the skin of the face.

Its Use is to pull the skin of the neck downwards, and somewhat laterally ⁽¹⁷⁹⁾.

The Muscles of the Lower Jaw.

The *Lower Jaw* has five pair of muscles: accordingly it is moved by ten muscles.

⁽¹⁷⁷⁾ Winslow called it *Quadratus*, and Douglas *Depressor Labii Inferioris proprius*.

⁽¹⁷⁸⁾ Innes called it *Levator Labii inferioris*, and Douglas *Elevator Labii inferioris proprius*.

⁽¹⁷⁹⁾ Winslow and Innes called this muscle *Musculus Cutaneus*. Douglas called it *Quadratus Genae*, or *Latissimus Colli*; which latter appellation is also given to it by Albinus. This muscle has no tendon. When the jugular veins are opened, this muscle is unavoidably wounded. Bronchotomy, Tracheotomy, or Laryngotomy, is performed between the two muscles.

I. The

1. The *Masseter*.
2. The *Temporalis*.
3. The *Pterygoideus internus*.
4. The ————— *externus*.
5. The *Biventer Maxillae inferioris*.

1. The *Masseter* is a thick, strong muscle, arising by a double or triple beginning from the *zygoma*, and from the inferior part of the *os malae* it descends somewhat obliquely, and adheres to the external surface of the angle of the lower jaw.

It must be remembered that the duct of the parotid gland runs over this muscle.

Its *Use*. It concurs to raise the lower jaw, and to shut the mouth (¹⁸⁰).

2. The *Temporalis* is a broad flat muscle, arising from the semicircular ridge that is conspicuous on the sides of the skull; therefore, it is connected to the *os frontis*, *os syncipitis*, and *os temporale*; and it covers the whole of the inclosed surface, the temporal and zygomatic depression, and is defended by the two *laminae* of the *cranium*, which separate from each other in this place. Its fleshy fibres come nearer to one another, at the zygomatic arch, they become tendinous externally, but internally they retain their former fleshy nature; they pass under the zygomatic arch, and adhere,

(¹⁸⁰) Mr. Hunter has treated very accurately of the figure, articulation, and motion of the lower jaw; and they who wish particularly to understand it, may read him (The Natural History of the Teeth, &c. Part. I. p. 15. Edit. II.).

by means of a strong tendon, to the coronoid process of the lower jaw. This muscle is covered, superiorly and inferiorly, by a strong aponeurotic expansion ⁽¹⁸¹⁾.

Its *Use*. It raises the lower jaw, and, in part, draws it to the sides.

3. The *Pterygoideus major*, or *internus*, arises, by fleshy fibres, from the cavity of the pterygoid *fovea*, which it almost fills, at the inner side of the external *ala*: it descends obliquely, from this origin, to the angle of the lower jaw; and after becoming tendinous it is inserted into the inside of this bone, almost in the same manner as the *masseter* is inserted into the outside.

Its *Use* is to raise the lower jaw, and to draw it to one side.

4. The *Pterygoideus minor*, or *externus*, is situated almost transversely on the external pterygoid process, and head of the lower jaw: it adheres, by a small tendinous beginning, to the external surface of the external pterygoid process, and also to a part of the lower jaw, contiguous to this process: it passes afterwards posteriorly and externally, and it is connected by another extremity to a small cavity in the lower jaw immediately under its head, and likewise to the capsular ligament and the margin of the inter-articular cartilage at this place.

(¹⁸¹) Winslow called it the *Crotaphite Muscle*.

Its *Use*. It draws the lower jaw forwards, and causes the inferior *incisores* and *canini* to project before the superior. But it does this, when both muscles act at once; for, when only one acts, it draws the lower jaw obliquely forwards.

5. The *Digastricus Maxillae Inferioris*, arises by a tendinous beginning from the inside of the lower jaw, near its *symphysis*, and above the *mylohyoideus* muscle: it is thick immediately at its origin, and becoming fleshy, it goes about the breadth of two fingers obliquely downwards and outwards. It then becomes tendinous, and adheres to the aponeurotic expansion that covers the *os hyoides*. And passing afterwards upwards and backwards over the *stylomyoideus* muscle, which it perforates, it is changed into a second fleshy belly, which is lastly inserted into a depression of the mastoid process of the temporal bone, by means of a tendon.

Its *Use* is to draw down the lower jaw, to open the mouth, and, when the mouth is open, to elevate the *os hyoides* ⁽¹⁸²⁾.

Muscles of the Os Hyoides.

There are five pair of muscles proper to the *os hyoides*; five on each side: viz.

1. The *Sternohyoideus*.
2. The *Coracohyoideus*.
3. The *Stylohyoideus*.

(182) Albinus called it "*Biventer Maxillae Inferioris*."

4. The *Mylohyoideus*.5. The *Geniohyoideus*.

1. The *Sternohyoideus* is a long, small, flat muscle, arising superiorly and somewhat laterally, by fleshy fibres, from the internal surface of the *sternum*: it ascends on the fore part of the neck, and is attached to the inferior margin of the base of the *os hyoides*.

Its *Use* is to draw the *os hyoides* downwards.

2. The *Coracohyoideus* is very long, thinner than the former, and arising from the superior margin of the *scapula*. Its fleshy fibres ascend very obliquely, and are inserted laterally into the base of the *os hyoides* ⁽¹⁸³⁾.

Its *Use* is to draw the *os hyoides* downwards, and somewhat laterally.

3. The *Stylohyoideus* is long, and somewhat round: it arises, by a short tendon, from the base of the styloid process of the temporal bone; and it is inserted into the *os hyoides*, chiefly at the union of the larger *cornua* with the rest of the bone. The fleshy fibres of this muscle, especially at their end, are separated from one another, that the tendon of the *digastricus* muscle may pass through them ⁽¹⁸⁴⁾.

⁽¹⁸³⁾ Innes called it *Omo-hyoideus*.

⁽¹⁸⁴⁾ The belly of this muscle is generally perforated, on one, or both sides, by the tendon of the *digastricus* muscle.

Some call this muscle *Stylo-cerato-hyoideus* (Schreiber.).

Another muscle frequently accompanies this, having the same origin, insertion, and use, called *Stylo-hyoideus alter* (Innes).

Its

Its *Use*. When it acts, it draws the *os hyoides* laterally, and upwards.

4. The *Mylohyoideus* is broad, but thin: it adheres to the very small internal and lateral parts of the lower jaw, and the base of the *os hyoides*. It arises near the last *dens molaris*, almost at the symphysis of the lower jaw, at its most anterior part. From hence it passes obliquely inwards, and is joined, in its whole length, with the corresponding muscle of the opposite side, by means of an intervening tendon. Lastly, it is inserted into the superior part of the base of the *os hyoides*.

5. The *Geniohyoideus* is a small, long, flat muscle, arising from the symphysis of the lower jaw, running straight downwards towards the *os hyoides*, and being inserted into its base, under the former.

Its *Use*, as well as that of the *Mylohyoideus*, is to draw the *os hyoides* forwards and upwards.

Muscles of the Tongue.

To the Tongue are destined six pair of muscles: *viz.*

1. The *Ceratoglossus*,
2. The *Bassiglossus*,
3. The *Chondroglossus*,
4. The *Genioglossus*,
5. The *Styloglossus*,
6. The *Lingualis*.

1. The *Ceratoglossus* muscle arises from the large *cornu* of the *os hyoides*, ascends somewhat obliquely, and is implanted in the side of the tongue ⁽¹⁸⁵⁾.

Its *Use* is to draw the tongue backwards and laterally.

2. The *Bassiglossus* arises from the base of the *os hyoides*, and its superior margin: its fleshy fibres are lost near the middle of the tongue.

Its *Use* is to draw the tongue backwards and inwards,

3. The *Chondroglossus* is very small; and, if it be present, is composed of a few fleshy fibres, that come from the cartilage connecting the large *cornua* to the base of the *os hyoides*, and are inserted into the tongue laterally ⁽¹⁸⁶⁾.

Its *Use* is the same as that of the former.

4. The *Genioglossus* arises by thick fleshy fibres from the symphysis of the lower jaw, runs backwards along the tongue, and is inserted into its under part ⁽¹⁸⁷⁾.

Its *Use* is to draw the tongue forwards.

5. The *Styloglossus* is long and small; it arises tendinous from the external part of the

⁽¹⁸⁵⁾ Albinus called it *Basio-cerato-chandro-glossus*, and Innes *Hyo-glossus*.

⁽¹⁸⁶⁾ Douglas comprehends this and the two former muscles under the name of *Ceratoglossus*.

⁽¹⁸⁷⁾ Winslow once called it, in his private lectures, *Musculus Polychrestus*, because of its various actions (*Expos. Anat. Tome II. Sect. X. § 526.*).

styloid process, descends obliquely by the sides of the tongue, adheres to it, and sends off its extremity, from this place, to be inserted into the tip of the tongue.

Its *Use*. When both act, they draw the tongue backwards and upwards; when only one acts, the tongue is drawn towards the side of the acting muscle.

6. Under the name of *Lingualis*, or *Musculi linguales*, come all those fleshy fibres of which the tongue is composed.

Its *Use*. When this muscle acts, the tongue is contracted, bent, and rendered broader or narrower.

Muscles of the Pharynx.

The superior part of the alimentary tube, or *pharynx*, consists principally of fleshy fibres, which adhere to different adjacent parts, and have accordingly different names given by authors. They may all be reduced to the following six pair.

Three muscles of the *pharynx* are *Sphincters*.

1. The *Constrictor Pharyngis superior*,

2. ————— *medius*,

3. ————— *inferior*,

4. The *Salpingopharyngeus*,

5. The *Palatopharyngeus*,

6. The *Stylopharyngeus*.

1. The *Constrictor Pharyngis superior* muscle.

As the heads of this muscle are so numerous,

anatomists have divided it into so many distinct muscles, and have signalized each by a proper appellation.

The fleshy fibres of this muscle arise from the *genioglossus*, the *ceratoglossus*, the *buccinator*, the *hamulus* and internal *lamina* of the internal petrous apophysis, the *circumflexus palati* muscle, the *stylopharyngeus*, and many others: they ascend obliquely backwards, and surround the superior part of the *pharynx* on both sides, and are united with the *constrictor pharyngis medius*.

2. The *Constrictor Pharyngis medius* arises from the *cornu* of the *os hyoides*; its fleshy fibres ascend obliquely backwards, surround the middle part of the pharynx, uniting on both sides, and forming an acute angle; and, lastly, they pass into a thin small tendon, which is annexed to the cuneiform process of the *os occipitis* near the condyles.

3. The *Constrictor Pharyngis inferior* is a broad, thin muscle. It arises from the inferior process of the thyroid cartilage, and also from the cricoid cartilage, by broad fleshy fibres. These fleshy fibres, like those of the *Constrictor Pharyngis medius*, ascend obliquely backwards, surround the inferior part of the pharynx, and, uniting on both sides, constitute almost a perfect acute angle. Because of this double origin, some authors have made two distinct muscles of it, one of which they called *Thyropharyngeus*, and the other *Cricopharyngeus*. Lastly, some have comprehended

prehended the three muscles above described under one name, *Musculus Sphincteris Gulæ* ⁽¹⁸⁸⁾.

The *Use* of these three pair of muscles is clear from their names.

4. The *Salpingopharyngeus* arises from the posterior extremity of the Eustachian Tube, as well from the bony as the cartilaginous part; it descends from thence obliquely, is joined with the *stylopharyngeus* muscle, and ends in the *pharynx* ⁽¹⁸⁹⁾.

Its *Use* is to elevate, and consequently to dilate the *pharynx*.

5. The *Palatopharyngeus* arises from the posterior margin of the *os palati*, the base of the *columella*, and also from the internal pterygoid process: it runs along the soft palate; is turned to one side, and somewhat backwards, at the end of the soft palate, descends on the side of the *pharynx*, is joined to the *salpingopharyngeus* muscle, and terminated in the *pharynx* and thyroid cartilage ⁽¹⁹⁰⁾.

⁽¹⁸⁸⁾ Douglas considered the upper part of the *pharynx* as made up only of one pair of muscles, one on each side, which he called *Pharyngæus*: but, in imitation of the accurate Valsalva, he confesses that he describes each different order of fibres separately, and names it from its origin. Consult Innes.

⁽¹⁸⁹⁾ This muscle, the *Salpingopharyngeus* of Albinus, is formed of some of the fibres of the *Thyreosaphilinus* of Douglas, or the *Thyro pharyngo-saphilinus* of Winslow.

⁽¹⁹⁰⁾ This is the *Thyreosaphilinus* muscle alluded to in the former note.

Its

Its *Use* is the same as that of the former muscle. When it acts, with its fellow, it draws the soft palate downwards.

6. The *Stylopharyngeus* arises posteriorly from the middle of the styloid process, by very small tendinous fibres, which immediately become fleshy, and are united into a round bundle. This bundle descends obliquely inwards, is mixed with the fibres of the *palatopharyngeus*, and terminated in the sides of the *pharynx* and the thyroid cartilage.

Its *Use*. When both act, the pharynx is elevated, opened, and shortened; when only one acts, it is elevated laterally.

Muscles of the Soft Palate and Uvula.

The *Soft Palate*, or *Velum Pendulum Palati*, together with the *Uvula*, has the following muscles, viz.

1. The *Palatopharyngeus*,
2. The *Constrictor Isthmi Faucium*,
3. The *Levator Palati Mollis*,
4. The *Circumflexus Palati*,
5. The *Azygos Uvulae*.

1. The *Palatopharyngeus* is already described among the muscles of the *pharynx*.

Its *Use* is to draw the palate downwards.

2. The *Constrictor Isthmi Faucium* is very small. It arises inferiorly from the side of the root of the tongue, in the anterior, or small arch of the soft palate; it ascends, and forms a part

a part of this arch, and it is inserted into the *uvula* ⁽¹⁹¹⁾.

Its *Use* is to draw the soft palate towards the root of the tongue.

3. The *Levator Palati Mollis* is a strong, fleshy muscle, arising from the extremity of the petrous portion of the temporal bone, and also from the cartilaginous part of the Eustachian tube; being more expanded, it descends to the *uvula*, forms with its fellow coming from the opposite side the posterior, or large arch of the *velum pendulum palati*, and ends in the root of the *uvula* ⁽¹⁹²⁾.

Its *Use* is to apply the palate to the posterior *foramina* of the nose, and the Eustachian tube.

4. The *Circumflexus Palati*, or *Palatinus Posticus* arises near the preceding from the petrous portion of the temporal bone, from the sharp process of the internal wing of the *os cuneiforme*, and from the cartilaginous part of the Eustachian Tube. Being expanded, it descends from hence through the semicanal of the *hamulus* of the pterygoid process; its tendon is turned backwards, and being united with its fellow, is inserted into the smooth edge of the *os palati* ⁽¹⁹³⁾.

Its

⁽¹⁹¹⁾ The *Glossostaphilin* of Winslow and Douglas.

⁽¹⁹²⁾ The *Levator Palati Mollis* of Albinus; the *Salpingostaphilin* of Valsalva; the *Pterigo-staphilin* *externus*, *vulgo*, of Douglas; the *Petro-Salpingostaphilin*, or *Salpingostaphilin internus* of Winslow; the *Levator Palati*.

⁽¹⁹³⁾ Winslow called it *Spheno-salpingostaphilin*, or *Sta-*

Its *Use* is to stretch the posterior soft part of the palate, to draw it downwards and forwards, and probably to open the Eustachian tube.

5. The *Azygos Uvulae* arises posteriorly at the union of the bones of the palate; it descends on the posterior part of the *velum* as far as the top of the *uvula*, and it is there terminated (¹⁹⁴).

The *Use* of this muscle is to shorten the *columella*, and to contract it.

Muscles of the Larynx.

To the *Larynx*, or *Head of the Aspera Arteria*, belong three pair of muscles, viz.

1. The *Sternothyroideus*,
2. The *Hyothyroideus*,
3. The *Cricothyroideus*.

1. The *Sternothyroideus* is long, flat and smooth. It arises from the superior and internal surface of the *sternum*, from the adjacent part of the clavicle, and from the cartilage of the first rib. It ascends from hence over the thyroid gland, and is connected to the side of the thyroid cartilage (¹⁹⁵).

Staphilinus externus. It is the *Musculus Tubae novus* of Valsalva, the *Palato-salpingeus* of Douglas, the *Tensor Palati* of Innes.

(¹⁹⁴) This solitary muscle is called by Douglas *Palato-staphilinus*, by Winslow *Staphilinus* or *Epistaphilinus*.

(¹⁹³) In bronchotomy, the incision should be made in the small interstice between these two muscles.

Its

Its *Use* is to draw the thyroid cartilage, and of consequence the *larynx* downwards.

2. The *Hyothyroideus*, is a small, flat, and narrow muscle, arising from the base of the *os hyoides*, also from its *cornu*; it passes downwards, and is implanted, over the preceding, into the side of the thyroid cartilage ⁽¹⁹⁵⁾.

Its *Use* is to elevate the *larynx*.

3. The *Cricothyroideus* arises from the anterior part of the cricoid cartilage, and is inserted laterally into the thyroid cartilage.

Its *Use* is to draw both cartilages nearer to each other.

Muscles of the Rima Glottidis.

These are the following, *viz.*

1. The *Cricoarytenoideus posticus*,
2. The ————— *lateralis*,
3. The *Thyroarytenoideus*,
4. The *Arytenoideus transversus*,
5. The ————— *obliquus*.

1. The *Cricoarytenoideus posticus*, with its fellow of the opposite side, covers almost the whole of the middle of the posterior part of the cricoid cartilage. It arises posteriorly from its convex surface, ascends obliquely inwards and upwards, and is affixed to the base of the arytenoid cartilage.

⁽¹⁹⁶⁾ Innes calls it *Thyreo-hyoideus*.

Its

Its *Use* is, with its fellow, to dilate the *rima glottidis*, and to enlarge it.

2. The *Cricoarytenoideus lateralis* is small, and arises from the side of the cricoid cartilage, ascends towards the arytenoid cartilage, and is connected laterally with the base of the arytenoid cartilage, near the former.

Its *Use*. When both act, they draw the arytenoid cartilages asunder, and consequently enlarge the *rima glottidis*.

3. The *Thyroarytenoideus* is very small; it arises from the inferior and internal part of the thyroid cartilage; it ascends, and it is inserted into its anterior part, immediately above the *cricoarytenoideus lateralis*.

Its *Use*. When both act, they render the anterior part of the *rima glottidis* narrow.

4. The *Arytenoideus Transversus* is a simple muscle, placed under the former; it passes transversely and posteriorly, from the internal margin of one of the arytenoid cartilages to the internal margin of the other, on the opposite side. It frequently sends fibres into the *arytenoidei obliqui* muscles, and runs with them to the *epiglottis*.

Its *Use* is to contract the *rima glottidis*, and make it narrow.

5. The *Arytenoideus Obliquus* is very small and narrow; it is smaller than any of the other muscles of the *rima glottidis*. It arises from the base of one of the arytenoid cartilages, and ascends obliquely to the posterior
and

and superior part of the other; in such a manner that the two muscles decussate each other, the right passing to the left cartilage, and the left to the right. Afterwards, it is inflected forwards over the anterior part of the cartilages, and goes to the *epiglottis*, in the side of which it is lost.

Its *Use*. When both muscles act, they render the *rima glottidis* narrow.

Some authors refer hither the three muscles of the *epiglottis*, one *elevator* and two *abductores*; but the fibres of these muscles are often wanting, or are so small as not to deserve particular names.

Muscles of the Head.

To the Motion of the Head are destined thirteen pair of muscles, viz.

1. The *Sterno-mastoideus*,
2. The *Cleido-mastoideus*,
3. The *Rectus Anticus major*,
4. The ————— *minor*,
5. The ——— *lateralis capitis*,

All which five bend the head forwards.

1. The *Splenius Capitis*,
2. The *Biventer Cervicis*,
3. The *Complexus major*,
4. The ————— *minor*, or *Trachelo-mastoideus*,
5. The *Rectus posticus major*,
6. The ————— *minor*,

All which six bend the head backwards.

1. The

1. The *Obliquus inferior capitis*, or *major*,
2. The ——— *superior* ———, or *minor*.

1. The *Sterno-mastoideus* arises, by a double tendon, from the superior part of the *sternum*, and the anterior extremity of the clavicle, the two separate portions unite immediately, and then ascend backwards, and are affixed by means of a strong tendon to the mastoid apophysis of the temporal bone, and to the *os occipitis*.

2. The *Cleido-mastoideus* is only that part of the *sterno-mastoideus*, which comes from the clavicle (¹⁹⁷).

3. The *Rectus Anticus Major*, or *Longus*, arises from the fore part of the transverse processes of the sixth, fifth, fourth, and third *vertebra* of the neck; it ascends towards the sphenoidal process of the *os occipitis*, and adheres to it, before the articular condyles (¹⁹⁸).

4. The *Rectus Anticus Minor*, is about an inch long. It arises from the base of the transverse process of the first *vertebra* of the neck; it ascends obliquely towards the sphenoidal

(¹⁹⁷) Douglas called it simply *Mastoidaeus*; but Innes called it *Sterno-cleido-mastoideus*. Leber has named it like Albinus.

The disease called *Wry-neck* is a contraction of one of these muscles. And in curing it, this muscle is divided.

(¹⁹⁸) This is the *Rectus Internus Major* of Douglas; the *Rectus Anterior Longus* of Winslow, and the *Rectus Capitis Internus Major* of Innes.

noidal

moidal process of the *os occipitis*, and adheres there, near the former ⁽¹⁹⁹⁾.

5. The *Rectus Lateralis*, which is nearly of the same length as the former, arises from the superior part of the transverse process of the first *vertebra* of the neck; and, having gone obliquely outwards and upwards, is at last connected to the *os occipitis*, near the mastoid apophysis, where this bone is connected with the temporal bone ⁽²⁰⁰⁾.

Use. All the muscles now mentioned, when they act on one side only, incline the head to that side.

1. The *Splenius*. This broad, flat muscle arises from the spinous processes of the five uppermost *vertebrae* of the back, and the five inferior *vertebrae* of the neck; it ascends obliquely, and adheres to the side of the *os occipitis*, at the beginning of the mastoid process ⁽²⁰¹⁾.

2. The *Biventer Cervicis* arises from the spinous processes of the *vertebrae* of the back; and, acquiring a double belly, it ascends

⁽¹⁹⁹⁾ The *Rectus Internus Minor* of Douglas; the *Rectus Anterior Brevis* of Winslow; the *Rectus Capitis Internus Minor* of Innes.

⁽²⁰⁰⁾ The *Transversalis Anticus Primus* of Winslow; the *Rectus Capitis Lateralis* of Innes.

⁽²⁰¹⁾ Albinus divides this muscle into two; the *Splenius Capitis*, or that portion coming from the cervical *vertebrae*, and the *Splenius Colli*, or that portion which comes from the dorsal *vertebrae*. See the Muscles of the Neck.

to the *os occipitis*, and is affixed to it, near the *complexus major* ⁽²⁰²⁾.

3. The *Complexus Major* arises by many small tendons from the transverse processes of the two or three superior dorsal *vertebrae*, and the six inferior cervical *vertebrae*; it is inserted superiorly into an unequal depression in the middle of the *os occipitis*.

4. The *Complexus Minor*, or *Trachelo-mastoideus*, is a small and narrow muscle; it arises from the same transverse processes as the former; to the tendons of which it is joined at its beginning. It passes upwards, joins the *splenius*, and is connected, under the *splenius*, with the posterior margin of the mastoid process ⁽²⁰³⁾.

5. The *Rectus Posticus Major* arises from the spinous process of the second *vertebra* of the neck; it runs somewhat obliquely upwards and outwards, and is affixed to the *os occipitis*, under the *complexus major* ⁽²⁰⁴⁾.

6. The *Rectus Posticus Minor* arises from the posterior eminence of the first *vertebra* of

⁽²⁰²⁾ The *Biventer Cervicis*, so called by Albinus, is a long portion of the *complexus major*, situated next the spinous processes, lying more loose, and having a roundish tendon in its middle.

The *Complexus Major* is simply called *Complexus* by Douglas, Heister, Innes, and most writers.

⁽²⁰³⁾ Called *Complexus Minor*, or *Mastoideus Lateralis* by Winslow, and *Trachelo-mastoideus*, or *Capitis Par Tertium Fallopii* of Douglas.

⁽²⁰⁴⁾ Called by Winslow and Douglas, *Rectus Major*, and by Innes, *Rectus Capitis Posticus Minor*.

the

the neck; it ascends a little obliquely, and adheres, near the former, to the neighbourhood of the *foramen magnum occipitale* ⁽²⁰⁵⁾.

1. The *Obliquus Inferior* arises from the spinous process of the second *cervical vertebra*. At its beginning, it is tendinous; but it soon becomes fleshy, goes obliquely outwards to the extremity of the transverse process of the first *cervical vertebra*, and is fixed in its posterior part ⁽²⁰⁶⁾.

2. The *Obliquus Superior* arises tendinous from the extremity of the transverse process of the first *cervical vertebra*; it ascends very obliquely backwards, and is at last connected to the inferior transverse ridge of the *os occipitis*, immediately above the end of the *rectus posticus major* ⁽²⁰⁷⁾.

Muscles of the Neck.

The *Motion of the Neck* is produced by ten pair of muscles, taking five parts of the *scalenus* for one only.

1. The *Splenius Colli*,
2. The *Spinalis Cervicis*,
3. The *Interspinales Cervicis*,

Which bend the neck backwards.

⁽²⁰⁵⁾ The *Obliquus Minor* of Winslow and Douglas; the *Rectus Capitis Posticus Minor* of Innes.

⁽²⁰⁶⁾ *Obliquus Capitis Inferior* of Innes.

⁽²⁰⁷⁾ *Obliquus Major* of Winslow; *Obliquus Superior* of Douglas; *Obliquus Capitis Superior* of Innes.

1. The *Longus Colli*,
Which bends the neck forwards.
1. The *Transversalis Cervicis*, or *Magnus Colli*,

2. The *Cervicalis Descendens*,
Which turn the neck round.

1. The *Scalenus*,

2. The *Intertransversarii priores colli*,

3. ————— *posteriores* —,

4. The *Levator Scapulae*.

Which turn the neck to one side.

1. The *Splenius Colli* is not a distinct muscle; but only a part of the *Splenius Capitis*, ⁽²⁰⁸⁾ adhering to the transverse process of the first and second cervical *vertebrae*, by a double ending.

2. The *Spinalis Cervicis* arises, by a tendinous beginning, from the transverse processes of the five, or six superior *vertebrae*; the tendons immediately uniting, pass into a fleshy belly, which becoming tendon, is affixed to the spinous processes of the second, third, fourth, fifth, and sixth cervical *vertebrae* ⁽²⁰⁹⁾.

Its *Use* is to raise the neck, when inclined forwards, and to turn it obliquely sideways and backwards.

3. The *Interspinales Cervicis*. These five small muscles are situated between the spinous processes of the six inferior cervical *vertebrae*.

⁽²⁰⁸⁾ See Note 174.

⁽²⁰⁹⁾ *Semi-spinalis*, or *Transverse-spinalis Colli*, of Winslow; *Spinalis*, of Douglas; *Semi-spinalis Colli*, of Innes.

The first of them arises from the superior part of the seventh cervical *vertebra*, and ends in the inferior and inner part of the spinous process of the sixth. The rest of the *inter-spinales* adhere to the other spinous processes of the cervical *vertebrae*, as the first to the sixth ⁽²¹⁰⁾.

Use. They draw the processes nearer together, erect the neck, when bent forwards, and draw it backwards.

1. The *Longus Colli* arises from the body of the three superior dorsal *vertebrae*, ascends into the neck, adheres to the bodies of the cervical *vertebrae*, and ends at the anterior eminence of the first cervical *vertebra* ⁽²¹¹⁾.

Its *Use* is to erect the neck, when it is bent backwards, to draw it forwards, and somewhat sideways.

1. The *Transversalis Cervicis*, or *Magnus Colli*, adheres to the *longissimus dorsi*, with which it is often very firmly united. It arises from the extremities of the transverse processes of the four or six uppermost *vertebrae* of the back, by as many small tendons; from hence it ascends, and is connected by intermediate tendons to the transverse processes of the six inferior *vertebrae* of the neck.

⁽²¹⁰⁾ A *vertebra* often wants such a muscle; so that the muscle from the *epistropheus* goes to the fourth cervical *vertebra* (Schreiber.).

Innes says, they "are rather small tendons than muscles, serving to connect the spinal and transverse processes."

⁽²¹¹⁾ *Longus* of Douglas.

Its *Use* is to draw the neck to one side, and to bend it obliquely backwards.

2. The *Cervicalis Descendens* arises by short tendons from the third, fourth, fifth, and sixth superior rib; and becoming fleshy, it ascends behind the *levator scapulae* and *complexus minor*, and is inserted into the transverse processes of the six inferior cervical *vertebrae*; where it is also joined to the *splenius colli* ⁽²¹²⁾.

Its *Use* is to move the neck almost like the former.

1. The *Scalenus* arises from the external surface of the first, second, and often the third true rib; it ascends obliquely to the transverse processes of the cervical *vertebrae*, to which it adheres, in order, from the last to the first. Between this muscle are situated the nerves and blood-vessels that go to the arm. This muscle may easily be divided into five small muscles: hence, in Albinus, and other books, we find the *Scalenus Colli Anterior*, *Posterior*, *Medius*, *Lateralis*, and *Minimus* ⁽²¹³⁾.

2. The *Intertransversarii Priores Colli*. These six short, small muscles pass from one transverse process of the cervical *vertebrae* to another. Each of them arises from the superior and posterior part of the transverse process of a *vertebra* of the neck, and ter-

⁽²¹²⁾ The *Cervicalis Descendens* is a fleshy slip running from the upper part of the *sacrolumbaris*, and is scarcely at all noticed by some Anatomists.

⁽²¹³⁾ Consult Innes,

minates in the inferior and anterior part of the transverse process of the *vertebra* next above it.

Its *Use* is to draw the neck sideways, and to erect it when inclined to the opposite side.

3. The *Intertransversarii Posteriores Colli*, like the former, arise and ascend from one transverse process of the neck to another. Each of them arises from the superior and anterior part of the transverse process, and goes to the inferior and posterior part of the superior transverse process.

Their *Use* is the same as that of the preceding.

4. The *Levator Scapulae* is a long broad muscle, arising from the transverse processes, on the posterior part, of the second, third, fourth, and fifth cervical *vertebrae*, and being inserted into the superior part of the angle of the *scapula* ⁽²¹⁴⁾.

Its *Use* is to draw the neck to one side, and somewhat backwards, and to concur with others to raise it, when bent forwards.

Muscles of the Back and Loins.

To the common motion of the back and loins are dedicated the following muscles, viz.

1. The *Multifidus Spinae*,
2. The *Longissimus Dorsi*,
3. The *Sacro-lumbaris*.

⁽²¹⁴⁾ *Angularis*, vulgo *Levator proprius* of Winslow; *Elevator*, or *Musculus Patientiae* of Douglas.

The following muscles are destined particularly for the *motion of the Dorsal Vertebrae*, viz.

1. The *Spinous Dorfi Magnus*, or *Semi-spinalis*,

2. The *Interspinales Dorfi*,

3. The *Intertransversarii Dorfi*,

The following muscles serve for the *motion of the Lumbar Vertebrae*, viz.

1. The *Quadratus Lumborum*,

2. The *Intertransversarii Lumborum*,

3. The *Interspinales Lumborum*,

4. The *Psoas Parvus*.

1. The *Multifidus Spinae* occupies the posterior part of the spine. It arises, by four tendons, from four eminences on the back of the *os sacrum*; it ascends obliquely towards the spinous processes, and adheres by them to all the *vertebrae* of the spine, except the first of the neck. So that it is connected to the superior oblique processes of all the lumbar *vertebrae*, to the transverse processes of all the dorsal *vertebrae*, and to the oblique descending processes of the six inferior cervical *vertebrae*. The tendons of this muscle do not pass only to one *vertebra*; but they send numerous fibres to the second, third, fourth, and even to the fifth *vertebra* placed above.

Its Use. By means of its numerous attachments, it retains the spine when it is bent forwards; it erects the spine, bends it backwards, and, in some measure, draws it to one side.

The

The inferior part of this muscle is called by some Anatomists *Sacer Lumborum* ⁽²¹³⁾.

2. The *Longissimus Dorsi* is a long, thick muscle, arising by fleshy fibres from the posterior, internal, and superior part of the *os ilei*; also from the superior spinous processes of the *os sacrum*; and from the spines of the four inferior lumbar *vertebrae*, by means of a broad tendon. Besides, it is fixed to the transverse and oblique processes of the lumbar *vertebrae*, by fleshy fibres. From its origin, it ascends, united to the *sacrolumbaris*, the whole length of the back, adhering not only to the angles, but also to the transverse processes of the seven superior dorsal *vertebrae* ⁽²¹⁶⁾.

3. The *Sacrolumbaris* is a long muscle, thin and small above, but thick and broad below. It arises posteriorly from the superior and external part of the *os ilei* and *os sacrum*, by means of a broad tendon. Ascending hence to the transverse process of the lowermost cervical *vertebra*, it ends in it. In this course, it adheres by means of numerous fleshy fibres to all the transverse processes of the dorsal *vertebrae*; and by means of numerous tendons, to the posterior part of almost all the ribs. From its origin to the last rib, it

⁽²¹⁵⁾ *Semi-spinalis*, or *Transverso-spinalis Colli Pars interna* of Winslow.

⁽²¹⁶⁾ Innes says that, "From the upper part of this muscle there runs up a round fleshy portion, which joins with the *cervicalis descendens*." See (212).

is firmly united to the *longissimus dorsi*. It is united superiorly with the *cervicalis descendens*.

Its Use. It serves, together with the *longissimus dorsi*, to bend the loins and spine backwards, when they are inclined forwards, and to erect them, and draw them sideways. The ribs, to which it adheres by its tendons, are particularly drawn downwards by it.

Muscles of the Back.

1. The *Spinofus Dorsi Magnus* is situated laterally at the spinous processes of the back. It arises from the spinous processes of the first lumbar *vertebrae*, and from the three inferior dorsal *vertebrae*, by means of as many distinct tendons. It is confounded in its course with the *longissimus dorsi*; and ends in the spinous processes of the sixth, fifth, fourth, third, and second dorsal *vertebra*.

Its Use. It sustains, and erects the back: it draws it somewhat sideways and backwards.

The *Semispinalis Dorsi* of Albinus seems to be a part of the former muscle.

2. The *Interspinales Dorsi* arise from the spinous processes of the dorsal *vertebrae*, as the *interspinales cervicis* arise from the spinous processes of the cervical *vertebrae* ⁽²¹⁷⁾.

Use. They draw the *vertebrae* downwards and near together: of consequence they raise the spine when bent, and draw it backwards.

⁽²¹⁷⁾ See note 210. Innes observes the same of these muscles as of those of the neck.

3. The *Intertransversarii Dorsi* arise from the transverse processes of the dorsal *vertebrae*, in the same way as the *intertransversarii colli* from the transverse processes of the neck.

It must be observed, however, that the inferior of these muscles are thicker and larger, and that the superior are smaller as they are higher; so that the uppermost are rather ligaments than muscles.

Their *Use*. They draw the dorsal *vertebrae* near together, draw the spine to one side; and erect it, or retain it, when bent to the opposite side.

Muscles of the Loins.

1. The *Quadratus Lumborum* arises by a fleshy beginning from the posterior spine of the *os ilei*, and from the internal *labium* at the superior margin of the *os ilei*: it arises also from the transverse processes of the three or four inferior *vertebrae*, by means of as many tendons. It is inserted into the internal *labium* of the last spurious rib (²¹⁸).

Its *Use*. It moves the loins to one side, and erects them, and retains them, when bent to the opposite side.

2. The *Intertransversarii Lumborum* are short, broad, thick muscles. They arise, and are inserted like the *intertransversarii colli et dorsi*. It must, however, be observed of them, that

(²¹⁸) *Quadratus*, or *Lumbaris Externus* of Winslow.

the four first are inserted into the transverse processes of the loins, but that the fifth is inserted into the lowest dorsal, and the uppermost lumbar *vertebra*.

Their *Use*. They move the loins to one side, and they erect them, and retain them, when bent to the opposite side.

3. The *Interspinales Lumborum* are broad, thin, and tendinous at their origin and insertion. The first goes from the spinous process of the last lumbar *vertebra*, to that next above it. The second passes in the same manner from the second spinous process to the third. In the same manner, one goes from the third to the fourth, and from the fourth to the fifth. The last goes from the fifth spinous process of the loins, to the last spinous process of the back.

Their *Use*. They raise the loins, when they are bent forwards; and draw them backwards: they draw the spinous processes near together.

4. The *Psoas Parvus* is generally, but not always, to be found. It arises laterally by a narrow, small, and, in general, tendinous beginning, from the inferior margin of the last dorsal *vertebra*, and from the superior margin of the first lumbar *vertebra*: it then becomes fleshy, and ends by a broad, thin, tendon, at that part of the *os pubis*, where this bone adheres to the *os ilei*. Moreover, it sends off, externally, from its end, a broad thin tendon, that covers the *psoas magnus* and *iliacus internus*, and descends to the region of the *pubis*,
when

when it unites with the *aponeurosis* of the *fascia lata* of the thigh.

Its *Use*. It bends the loins forwards and sideways.

Muscles of the Os Coccygis.

To the *os coccygis* are referred four muscles, two being placed on each side: viz.

1. The *Curvator Coccygis*, or *Sacrococcygaeus*,
2. The *Ischio-coccygaeus*.

1. The *Curvator coccygis* is a small muscle, oblong, narrow, and thin, arising from the inferior part of the internal surface of the *os sacrum*; and terminating tendinous at the second, third, and fourth small bone of the *os coccygis*.

ALBINUS called this muscle *Curvator Coccygis*, from its office, as it bends this bone forwards. In some subjects, it rather resembles a ligament than a muscle.

2. The *Ischio-coccygaeus* is small, thin, and tendinous at both ends. It arises from the spinous process of the *os ischii*, and terminates by a broad tendon on the inside of the *os sacrum*, and *os coccygis* ⁽²¹⁹⁾.

Its *Use*. It bends the *os coccygis* forwards towards the *spine* of the *os ischii*, and draws it into its proper situation, when bent backwards.

⁽²¹⁹⁾ This is the *Coccygaeus* of Douglas and Innes.

Schrieber says, some are of opinion that it draws the coccyx backwards, when *foeces* are expelled, and during delivery (*Douglas Versio Latina.*).

It

It likewise strengthens the union of the *coccyx* with the inferior part of the *os sacrum*.

Muscles of the Thorax.

The *Muscles of the Thorax* are

1. The *Intercostales Externi*,
2. ————— *interni*,
3. The *Levatores Costarum longiores*,
4. ————— *breviores*,
5. The *Serratus posticus superior*,
6. ————— *inferior*,
7. The *Triangularis Sterni*,
8. The *Infracostales*,
9. The *Diaphragm*.

1. and 2. The *Intercostales externi* and *interni* are those muscles which fill up the space between the ribs. The *Externi* arise from the posterior extremity of the ribs: their fibres run obliquely forwards, and end at the beginning of the cartilages of the ribs. The *Interni* arise from the *sternum*: their fibres pass, contrary to the others, obliquely from before backwards, and are terminated at the angles of each rib: hence the posterior alone fill the space between the cartilages, and are, on this account, called *Intercartilaginei*. Each series of these muscles is fixed to the inferior margin of the upper rib and the superior margin of the rib next below it.

Use. The Use of both, the *externi* and *interni*, is to draw the ribs near together; and,

as

as the uppermost rib is less moveable than the rest, to raise the ribs (²²⁰).

3. The *Levatores Costarum Longiores* are four, proper to the four inferior ribs. The manner of their descent is such that they always pass over the rib next to them, and do not adhere to it, but to the next. Hence, the first of these muscles, running to the ninth rib, arises from the transverse process of the sixth dorsal vertebra; that running to the tenth rib, from the transverse process of the eighth; and, that, running to the eleventh rib, from the transverse process of the tenth.

They all arise tendinous, and, becoming fleshy, and again tendinous, are inserted into the superior and external part of the ribs. They are often united, in this course, with the intercostal muscles, and with the *levatores costarum breviores*.

(²²⁰) Hambergerus and others considered the *Intercostales Interni* and *Externi* as antagonist muscles; the former depressing the ribs in expiration, and the latter raising them. But Haller proved by experiment and reasoning that these muscles are not antagonists: that the opinion of Hambergerus, however specious, was not founded on true principles; and that both the *Interni* and *Externi* perform one common office of elevating the ribs (*Opuscula Anat. De Respiratione*).

The number of *intercostales externi* and *interni* is forty-four: eleven *externi*, and as many *interni* being on each side.

They do not raise all the ribs in inspiration; for the first rib is almost immoveable, and the rest are more moveable in the order of their inferiority. But the last three or four ribs, according to Boerhaave, Albinus, and others, either do not ascend at all, or descend and are drawn inwards.

They

They elevate the ribs. Those which are proper to the two last ribs, draw them backwards.

4. The *Levatores Costarum Breviores* correspond, in number, to the ribs, twelve being on each side. They arise from the extremities of the transverse processes of the eleven uppermost dorsal *vertebrae*, and of the last cervical *vertebra*, in such a manner, that each of these muscles arises from the transverse process which is above the rib to which the muscle goes. They all end, by means of tendons, at the sharp eminence of each rib, which is observable at its departure from the *vertebra*; and at the external part of the superior margin of the rib. The fibres are the straighter as they are nearer the *vertebrae*: and as they are at a greater distance from them, they are the more oblique.

Their *Use* is to strengthen the first rib, and to co-operate with other muscles in raising the rest ⁽²²¹⁾.

5. The *Serratus Posticus Superior* is situated under the *rhomboideus* and *cucullaris* muscles. It arises, by a broad tendinous origin, from the cervical ligament, from the spinous processes, and two lowermost cervical *vertebrae*,

(221) Thus Leber follows the example of Albinus in giving the name of *Levatores Costarum Longiores* and *Breviores* to those "portions of the external intercostal muscles which arise from the transverse processes of the *vertebrae*, where the ribs are fixed to them, and other portions that pass over one rib, and terminate in the next below it." Innes.

and the two uppermost of the back. It descends from hence obliquely forwards, and is inserted by means of broad fleshy and tendinous digitations into the second, third, fourth, and fifth true rib.

Its Use. It raises the rib to which it adheres.

6. The *Serratus Posterior Inferior* is situated under the *latissimus dorsi*. It arises, by a broad tendon, from the spinous processes of the three lowest dorsal *vertebrae*, and the two highest lumbar *vertebrae*. It ascends from hence fleshy, and is inserted by broad, fleshy digitations into the four lowest false ribs.

Its Use is to draw the ribs, into which it is inserted, downwards and backwards.

7. The *Triangularis Sterni* arises, by four broad tendons, from the second, third, fourth and fifth rib, anteriorly, on the inside of the cartilages of the ribs, by means of which these ribs are joined to the *sternum*. The fibres of this muscle then become fleshy, and are united together; they descend obliquely to the *sternum*, and end in a long and small tendon, which is annexed to the *sternum*, near the xyphoid cartilage.

Its Use is to depress, and draw inwards the cartilages of the ribs from which it arises. It draws the second rib especially downwards, and the others inwards (²²²).

8. The *Infracostales* are thin, flat, fleshy muscles, of an indeterminate number, situated

(²²²) The *Triangularis*, or *Sterno-costalis* of Innes.

posteriorly on both sides on the inside of the ribs. They arise from the small heads of the ribs, run obliquely downwards, and terminate in the angles of the ribs; but in such a manner that they are not fixed to the angle of the next rib, but to the angle of the second, or even the third below ⁽²²³⁾.

Their *Use*. They seem to draw the ribs downwards and somewhat inwards.

9. The *Diaphragm* is a strong, broad, double muscle, dividing the cavity of the *thorax* from the *abdomen*. It is placed obliquely between the cavities mentioned, so that the anterior part is placed higher than the posterior; it forms a kind of arch, the superior convex part of which is turned towards the *thorax*, and covered with *pleura*; the inferior and concave part being turned towards the *abdomen*, and covered with *peritoneum* ⁽²²⁴⁾.

This

⁽²²³⁾ *Costarum depressores proprii* of Cowper and Douglas.

⁽²²⁴⁾ The *Diaphragm*, *Septum transversum* of Celsus (*Lib. 4. Cap. 26.*).

Though the diaphragm be higher anteriorly than posteriorly, yet it is not highest anteriorly. For, in a dead body the tendinous expansion is higher than the fleshy part. This does not depend on the ascent of the diaphragm into the thorax, in consequence of the pressure of air in the *abdomen*; because, if you wound the *thorax*, and admit air, the tendinous expansion is still higher than the fleshy part of the diaphragm (Haller, *Opusc. Anat. De Musculis Diaph.*).

Some

This muscle *arises* from various parts: it arises fleshy anteriorly from the internal and superior part of the Xiphoid cartilage, and on both sides, from the cartilages of the sixth and seventh true rib, and of the following spurious ribs. Its fleshy fibres unite near the middle, and form a triangular tendon, which passes backwards and downwards⁽²²⁵⁾. Inferiorly, the diaphragm has two, but generally four beginnings on each side; these beginnings come by fleshy and tendinous fibres from the transverse process of the first, and from the body of the second lumbar *vertebra*; also by tendinous fibres, from the third and fourth lumbar *vertebrae*, and their intermediate cartilages. It must be observed, however, that these posterior beginnings are always lower on the right than on the left side. The fibres now mentioned becoming fleshy, ascend, and soon again become tendinous, and are united to the tendon of the diaphragm that descends from above, forming with it the broad tendon of the diaphragm:

Some make the diaphragm consist of two, and some of three muscles, and some of only one. But Haller agrees with Cowper, that the division of this muscle is of no moment (*Ibid.*). There is, however, in most books a division of the diaphragm that, in my opinion, serves only to create confusion; for that part of the diaphragm arising from the lumbar *vertebrae* is called the *Appendix*, or *Inferior*, or *Less Muscle* of the diaphragm, while the rest is simply called the *Diaphragm*, or the *Superior*, or *Larger Muscle* of the diaphragm.

⁽²²⁵⁾ *Centrum Tendinosum*, and *circulus nervosus*, are names commonly given to the tendinous expansion of the diaphragm.

In which broad tendon, four particular orders of fibres are conspicuous; one of which is situated posteriorly, another passes from the right to the left side, the third ascends to the right, and the fourth to the left.

Moreover, different *Foramina* and *Orifices* are conspicuous in the *diaphragm*. First, there is an aperture between the posterior beginnings of the *diaphragm*, through which pass the *aorta* ⁽²²⁶⁾, the thoracic duct, and sometimes the *vena azygos*, and two large intercostal nerves, all which are placed without the *pleura*. There is another *foramen* before and above the preceding, between the inferior muscles of the right and left side; the lateral and posterior part of this *foramen* is fleshy, but the anterior part is tendinous. Through this descend the *oesophagus* and the eighth pair of nerves into the *abdomen*. On the right side, there is a large *foramen* almost triangular, in the middle of the broad tendon; this *foramen* is encircled with the four bundles of tendinous fibres above mentioned. Through this *foramen* goes the *vena cava* from the liver to the anterior ventricle

(226) Haller observes that Car. Stephanus, and other ill-informed anatomists, have mistaken the passage of the *aorta*, *vena azygos*, and *ductus chyli* for a *foramen*; but he says, that their passage is behind the *pleura* and *diaphragm*, before the bodies of the *vertebrae*, under the *foramen* for the *oesophagus*, and between the inferior muscles of the *diaphragm* (*Opusc.*); so that, in fact, there are only two *foramina* in the *diaphragm*, that deserve to be mentioned.

of the heart. And, in this place, the *pleura* joins the *peritoneum*. The *foramen*, through which the *oesophagus* passes may accordingly be contracted ⁽²²⁷⁾; but this last mentioned *foramen* cannot be rendered, but a little, smaller, because its fibres cannot contract.

Lastly, there are other *foramina* in the diaphragm, through which pass numerous small nerves and blood-vessels.

When the fleshy fibres of the diaphragm contract, its upper part descends towards the *abdomen*: hence the cavity of the *thorax* is lengthened, and the concave part of the diaphragm, during this action, is rendered flat; therefore, the liver, stomach, spleen, &c. are pressed downwards. The lowermost false ribs are likewise drawn inwards and backwards, during the contraction of the diaphragm ⁽²²⁸⁾.

Tba

⁽²²⁷⁾ In an inflammation of the diaphragm deglutition was observed to be abolished by Heister; and difficult deglutition from a contraction of the diaphragm is not an uncommon symptom in hysterical persons (Haller, *Opusc. de Musc. Diaph. n. 36.*).

The Diaphragm, according to Bartholine and Boerhaave (*Inst. Med. § 75.*), is the superior sphincter of the stomach.

⁽²²⁸⁾ In ordinary respiration, the diaphragm only acts; the ribs being scarcely moved at all, except that the last two follow the motion of the diaphragm.

When the diaphragm acts, the top of its arch is depressed, and thus the cavity of the *thorax* is elongated, and of course that of the *abdomen* is lessened. Now as the lungs must always be contiguous to the sides of the *thorax*,

The Muscles of the Superior Extremities.

These are divided into the muscles of the *humerus*, the arm, the fore-arm, and the hand.

Muscles of the Humerus.

To the *humerus* are referred the Clavicle

it follows when the cavity of the *thorax* is enlarged, that a quantity of air must rush into, and expand the lungs.

The Diaphragm and Intercostal muscles both augment the capacity of the *thorax*, and perform *Inspiration* (Note 220.). In *Expiration* the diaphragm is relaxed. If respiration be laborious, and much blood be brought into the lungs, then the intercostal muscles act in inspiration, so that the thorax is not only rendered wider but also longer. In dying animals, and in such as have a very disturbed breathing, the ribs are raised by the *intercostales*, the *scaleni*, the *pectorales*, and other muscles. In laborious expiration, the *sterno-costales* and *serrati possici inferiores* pull down the ribs; and the *quadrati lumborum*, the *sacro-lumbares*, and the *longissimi dorsi* conspire.

Blumenbach says that the *Musculi obliqui* of both orders, and the *Musculi transversi, Abdominis*, are antagonists of the diaphragm (Inst. Phys. § 139.).

Coughing, or violent alternate inspirations and expirations succeeding each other quickly, is caused by whatever irritates the respiratory system.

Laughing is a mental affection, in which frequent, imperfect expirations quickly succeed one full inspiration.

Crying, or *Weeping*, begins by a full inspiration; after which several small, alternate, expirations and inspirations follow, and at last a deep expiration, and inspiration.

Hiccoughing is a very full, sudden, and sonorous inspiration.

Sneezing is produced by whatever irritates the Schneiderian membrane. It is performed by inspiring fully and expiring very forcibly; so that all the expiratory powers are exerted, and air is violently expelled through the nostrils.

and

and *Scapula*, to which belong the following muscles: viz.

1. The *Cucullaris*, or *Trapezius*,
2. The *Subclavius*,
3. The *Serratus Anticus Major*,
4. — — — — — *Minor*,
5. *Rhomboideus*,
6. *Levator Scapulae*.

Muscle that moves the Humerus.

The *Cucullaris*, or *Trapezius* is a large, flat, thin muscle, covering the greatest part of the neck and back. It arises fleshy from the uppermost and middle part of the *os occipitis*, from the seven spinous processes of the cervical *vertebrae*, and from the seven, and sometimes all the spinous processes of the dorsal *vertebrae*. Its fleshy fibres come more closely together near the *humerus*, they become tendinous, and end at the spine of the acromion, and the posterior part of the clavicle.

Its *Use*. It moves the *scapula* and clavicle variously, and raises the *humerus* backwards towards the head, and draws it directly backwards or downwards. When this muscle is in action, and thoroughly contracted, it draws the *humerus* backwards towards the spine (²²⁹).

(²²⁹) *Ligamentum Nuchae* is the common tendon of these muscles, which is loose behind the spinous processes of the cervical *vertebrae*.

Muscle that moves the Clavicle.

The *Subclavius* is a small muscle, arising by a flat tendon from the eminence which the first rib has at its connection with the xiphoid cartilage; it then runs fleshy along the inferior surface of the clavicle, and is connected to the inferior and posterior part of the clavicle.

Its *Use*. It draws the clavicle towards the *sternum*, and moves it forwards and downwards.

Muscles that move the Scapula.

1. The *Serratus Anticus Major* is a very broad, thin muscle; it arises by short tendinous fibres from the external surface of the six inferior true ribs, and of the two uppermost false ribs, by as many digitations; of which the three inferior are united to the digitations of the *obliquus externus abdominis*. Then, becoming fleshy, it ascends obliquely, grows narrow at its extremity, and adheres to the internal surface of the lowermost anterior angle of the *scapula* ⁽²³⁰⁾.

Its *Use* is to draw the *scapula* downwards.

2. The *Serratus Anticus Minor* arises by its digitations from the second, third, and fourth true rib: it ascends obliquely, and is affixed by a short, flat tendon to the coracoid process.

(²³⁰) The *Serratus Magnus* of Innes.

of the *scapula*, which it draws forwards and downwards towards the *thorax* ⁽²³¹⁾.

3. The *Rhomboideus* is a small muscle, arising tendinous from the spinous processes of the four or five inferior cervical *vertebrae*, and the four or five uppermost dorsal *vertebrae*. It becomes fleshy, and descends somewhat obliquely downwards to the base of the *scapula*, to which it adheres. It then sometimes passes to the inferior angle of the *scapula*, and is there joined to the *latissimus dorsi*. Some authors divide this muscle into two, calling the superior *Rhomboideus parvus*, and the inferior *Rhomboideus magnus* ⁽²³²⁾: but this division seems needless.

Its *Use*. It draws the *scapula* obliquely backwards, and moves it somewhat upwards.

4. The *Musculus Patientiae*, or *Levator Scapulae* may perhaps be referred hither. See its description above among the muscles of the neck.

Its *Use* is to raise the *scapula* forwards.

Muscles of the Arm.

To the motion of the arm are dedicated nine muscles: viz.

1. The *Deltoides*,
2. The *Supraspinatus*,
3. The *Coracobrachialis*,

⁽²³¹⁾ The *Serratus Anticus* of Albinus; the *Pectoralis Minor* of Innes.

⁽²³²⁾ Innes is of those authors.

Which

Which three raise the arm :

4. The *Pectoralis Major*,

Which draws the arm downwards and forwards :

5. The *Teres Major*,

6. The *Latissimus Dorsi*,

Which draw the arm backwards :

7. The *Subscapularis*,

8. The *Infraspinatus*,

9. The *Teres Minor*,

Which rotate the arm.

1. The *Deltoides*, which is a thick, very strong muscle, takes its name from its triangular figure, resembling the Greek letter, *Delta*, Δ . It arises, by a broad tendinous beginning, from the middle and posterior part of the clavicle, from the *acromion* and the spine of the *scapula*; running towards the anterior part of the arm, it always becomes narrower, and is connected by fleshy and tendinous fibres to the longitudinal eminences placed there, between which fibres run. This may easily be divided into seven other small muscles.

Its *Use*. It raises the arm directly outwards; when the anterior part is contracted, it draws the arm obliquely forwards; and, when the posterior part is contracted, it draws the arm backwards.

2. The *Supraspinatus* fills the whole superior cavity of the *scapula*. It arises from the posterior part of its cavity, passes over the head of the *os brachiale* under the *acromion*,

and adheres externally to its large protuberance by a short, flat, thick tendon.

Its *Uſe*. It raiſes the arm forwards, and draws it obliquely outwards.

3. The *Coracobrachialis* ariſes, by a tendinous and fleſhy beginning, from the coracoid proceſs, where the ſhort head of the *biceps* muſcle ariſes. It is joined to the *biceps* for ſome way, ſo that it appears as if it were a part of this muſcle. It ſeparates from the *biceps*, and ends near the middle of the *os brachiale*, on its inferior and internal part. It is perforated by the external, cutaneous nerves of the arm ⁽²³³⁾.

Its *Uſe* is to draw the *os brachiale* and clavicle near together, and to draw the arm to the ſide of the body.

4. The *Pectoralis Major* is a large, thick, fleſhy muſcle, ariſing tendinous from the whole anterior part of the clavicle, and from the whole length of the *ſternum*, where the cartilages of all the true ribs are joined to it. It alſo adheres externally with the broad tendon of the *obliquus externus abdominis*: the fibres ariſing fleſhy from this part aſcend, but the ſuperior fibres deſcend obliquely; and the middle fibres go tranſverſely to the *os brachiale*, in ſuch a manner, that they continually become leſs in their courſe, and are connected by a ſtrong tendon, four fingers

⁽²³³⁾ The middle of this muſcle is perforated by the nerve called *Perforans*, or *Muſculo-cutaneus*.

breadth broad, under the head of the *os brachiale*, to the acute line that descends from the great eminence. From the origin of this muscle pass numerous tendinous fibres to the *sternum*, which are united with fibres of the corresponding muscle coming from the opposite side, forming an aponeurotic expansion, covering the *sternum*, and adhering closely to it.

Its Use. It draws the arm, when hanging on its natural side, near to the side, and a little forwards. When the arm is raised straight, it depresses it, and moves it forwards: when the arm is raised forwards, it bends it towards the breast. When the descending fibres of this muscle only act, they raise the *os brachiale*: when the transverse fibres only act, they move the *os brachiale* forwards; and, when the ascending fibres only act, they not only draw the *os brachiale*, but also the whole *scapula* downwards.

5. The *Teres Major* is an oblong, smooth, thick muscle, arising from the inferior angle of the *scapula*; ascending, and being inserted by an expanded tendon between both eminences of the *os brachiale*, which it moves backwards and downwards.

6. The *Latissimus Dorsi* arises, by a broad tendon, from the four lowermost spurious ribs, near their cartilages, from the spinous processes of the six or eight inferior dorsal, and of all the lumbar *vertebrae*, of the *os sacrum*, and from the posterior part of the iliac

iliac spine. Becoming more contracted in its course, it goes to the inferior angle of the *scapula*, and terminates in a tendon, which is united with the tendon of the *teres major*, and is lastly affixed to the superior and internal part of the *os brachiale*.

Its *Use*. It draws the *os brachiale* downwards, and to the back; it draws it downwards, when elevated, and bends the *scapula* and clavicle by means of its inferior fleshy fibres.

7. The *Subscapularis* occupies the whole surface of the *scapula* that is turned towards the back. It arises from its posterior part, almost as far up as the neck of the *scapula*; becomes gradually smaller, like the *scapula*, as it runs forwards, till it ends, by a broad tendon, in the small, anterior, eminence of the *os brachiale*. It may easily be separated into many small muscles.

Its *Use*. It draws the arm remarkably inwards; hence it is an antagonist to the *infraspinatus* and *teres minor*.

8. The *Infraspinatus*, like the preceding, filling the cavity above the spine, fills the whole cavity below the spine. It arises from its whole convex surface, and also from the inferior margin of the *scapula*: it is larger than the preceding, and is broader at its beginning, but grows narrower in its course like a triangle, till it ends at last by means of a short, thick, and broad tendon, in the superior

superior and posterior part of the same eminence as the former.

Its Use. It rolls the arm, and moves its anterior part outwards from the *thorax*.

9. The *Teres Minor* arises from the margin and inferior angle of the *scapula*, by a beginning that is partly fleshy and partly tendinous. It ascends, becoming broader till it is finally ended in the great eminence immediately at the *infraspinatus*, and the inferior part of the neck of the *os brachiale*.

Its Use is the same as that of the *infraspinatus*.

Muscles of the Fore-arm.

To the motion of the fore-arm are-destined the following muscles: *viz.*

1. The *Brachiaeus Internus*,

2. The *Biceps Brachii*,

Which bend the fore-arm :

3. The *Triceps Brachii*,

4. The *Anconaeus*,

Which extend the fore-arm :

5. The *Pronator Rotundus*,

6. The ——— *Quadratus*,

7. The *Supinator Longus*,

8. The ——— *Brevis*,

Which are, all of them, *Pronators* and *Supinators*.

1. The *Brachiaeus Internus* arises from that part of the *os brachii* at which the *deltoides*

toides ends, by means of a tendon coming from each side of the *deltoides*: it is then affixed, by means of fleshy fibres, internally to the whole acute line of the *os brachiale*, that runs downwards, from the great eminence, passes over the articulation, and adheres to the inner and fore side of the *corona cubiti* ⁽²³⁴⁾.

Its *Use* is to bend the fore-arm.

2. The *Biceps Brachii* is composed of two muscles, that are joined together only at their extremity; the one arises, by means of a short, broad tendon, from the coracoid process, and descends as far as the middle of the *os brachii*. The other muscle arises by a small, long tendon from the superior part of the articular cavity of the *scapula*; the tendon passes through the capsular ligament, over the head of the *os brachiale*, descends in a *fulcus* between two eminences almost to the middle of the arm, where the tendons of both muscles unite to constitute the muscle, which goes on the inside of the arm as far as the articulation, where it disappears, being terminated partly by means of a narrow, round tendon, at the rough eminence of the *radius* projecting under its neck; and being partly expanded into an aponeurotic membrane covering all the muscles situated on the inside of the fore-arm, and to about three fingers breadth before the articulation of the *carpus*.

⁽²³⁴⁾ The *Brachialis* of Winslow; the *Brachialis Internus* of Innes.

When

When this aponeurosis is hurt in *venae section*, bad consequences often arise, which are noticed elsewhere ⁽²³⁵⁾.

Its *Use*. When the *radius* is rolled forwards over the *ulna*, this muscle rolls it back again. It can also bend the arm.

3. The *Triceps Brachii*. Some anatomists describe under this name three particular muscles: viz. the *Anconaeus Magnus*, the *Externus*, and the *Internus*. The first, or *Longus*, arises by means of a tendon from the inferior part of the neck of the *scapula*, and descends fleshy on the posterior side of the *os brachiale*. The second, or *Brevis*, arises from the external side of the neck of the *os brachiale*, and descends on the outside of this bone. The *Third* arises inferiorly from the outside of the *os brachiale*. They then come together at the inferior part of the *os brachiale*, and form a broad, strong, common tendon, which is fixed to the *olecranon*; from hence a broad, thin aponeurosis, like that of the *biceps*, is expanded over the anterior and posterior part of the fore-arm, covering all the muscles, and ending at the extremity of the fore-arm ⁽²³⁶⁾.

Its

⁽²³⁵⁾ The *Biceps Flexor Cubiti* of Innes; the *Coracoradialis* or *biceps* of Winslow; the *Biceps Internus* of Douglas.

See the Neurology for the remark on a wound of the aponeurosis of this muscle.

⁽²³⁶⁾ The *Anconeus major*, *Anconeus externus*, and *Anconeus internus* of Winslow; the *Biceps externus*, and
Bra-

Its Use. The whole of this muscle descends directly downwards, and when it acts, extends the fore-arm. The longer part of this muscle draws the arm to the side of the body, and a little backwards.

4. The *Anconæus* arises by a narrow, strong tendon from the inferior part of the external condyle of the *os brachiale*, and is terminated on the convex side of the *ulna*, immediately under the *triceps* ⁽²³⁷⁾.

Its Use. It concurs to extend the fore-arm.

5. The *Pronator Rotundus* arises from the internal condyle of the *os brachiale*, and passes obliquely to the *radius*, into the external margin of which it is inserted, by a broad tendon ⁽²³⁸⁾.

Its Use. It rolls the *radius* and *ulna*, and consequently the hand which follows the motion of the *radius* inwards.

6. The *Pronator Quadratus* resembles a regular quadrangle. It arises from the inferior part, and the internal surface of the cubit, and passes transversely to the adjacent inferior and internal part of the *radius* ⁽²³⁹⁾.

Its Use. It assists the action of the preceding muscles.

Brachialis externus of Douglas; the *Triceps extensor cubiti* of Innes.

⁽²³⁷⁾ *Anconeus minor* of Winslow; *Anconeus*, or *Cubitalis Riolani* of Douglas.

⁽²³⁸⁾ *Pronator Radii Teres* of Innes.

⁽²³⁹⁾ *Pronator Radii Quadratus* of Innes.

VOL. I.

X

7. The

7. The *Supinator Longus* arises, by a small flat beginning, from the external condyle of the *os brachiale*; descends over the whole convex surface of the *radius*, in the middle of which it is tendinous; and is inserted, by a small tendon, into the anterior part of the inferior condyle of the *radius* ⁽²⁴⁰⁾.

Its Use. It moves the *radius* to the *ulna*, on both sides; hence, it not only bends the hand outwards, but bends it inwards also, when it is bent outwards.

8. The *Supinator Brevis* arises, by a tendinous beginning, from the external condyle of the *os brachiale*; and by a fleshy beginning, from the eminence of the superior and external part of the cubit: it descends directly forwards, and downwards to the superior and internal part of the *radius*, to about the breadth of four fingers under its head: it entirely surrounds the *radius*, and terminates in its middle ⁽²⁴¹⁾.

Its Use. It draws the hand outwards, when bent inwards, and draws back the *radius*, when turned about the *ulna*.

Muscles of the Hand.

1. The *Radialis Externus*,

2. The *Ulnaris Externus*,

Both which extend the hand:

⁽²⁴⁰⁾ *Supinator Radii Longus* of Innes.

⁽²⁴¹⁾ *Supinator Radii Brevis* of Innes.

3. The

3. The *Ulnaris Internus*,
 4. The *Radialis Internus*,
 Both which bend the hand.

1. The *Radialis Externus* has a double origin, and is accordingly divided into the *Longus* and *Brevis*. They both arise tendinous from the external and inferior condyle of the *os brachiale*, descend along the external surface of the *radius*, pass into small, flat tendons in the middle of the *radius*, which pass through a furrow at its inferior extremity; and end on the back of the hand, in such a manner, that the tendon of the longer muscle is connected to the base of the first metacarpal bone, and the tendon of the shorter to the second ⁽²⁴²⁾.

Its *Use* is to turn the arm outwards.

2. The *Ulnaris Externus* arises from the external condyle of the *os brachiale*, and from almost the whole of the external surface of the *ulna*.

It descends along the *ulna*, and passes into a tendon in its middle, which disappears in the superior part of the fourth metacarpal bone, and the base of the first phalanx of the little finger ⁽²⁴³⁾.

⁽²⁴²⁾ Albinus and Winslow divide the *Radialis Externus* of Leber: the former, after the manner mentioned by Leber; the latter into *Radialis Externus Primus*, and *Radialis Secundus*. Innes also calls the *Radialis Externus Longior* of Albinus, *Extensor Carpi Radialis Longior*; and the *Radialis Externus Brevior* of Albinus, Innes calls *Extensor Carpi Radialis Brevior*.

⁽²⁴³⁾ *Extensor Carpi Ulnaris* of Innes.

Its *Use*. It turns the hand backwards, and a little outwards, and likewise raises it.

3. The *Ulnaris Internus*. It arises from the internal condyle of the *os brachiale*, descends along the outside of the *ulna*, and is connected by its tendon to the pisiform and unciform bones of the *carpus* ⁽²⁴⁴⁾.

Its *Use*. It bends the hand, and draws it inwards.

4. The *Radialis Internus* arises by a broad tendon from the internal condyle of the *os brachiale*, and descends obliquely over the *ulna*. Its tendon, beginning about the middle of this bone, passes under the internal transverse ligament of the *carpus*; and is inserted generally into the internal and superior part of the first bone of the *metacarpus* ⁽²⁴⁵⁾.

Its *Use* is like that of the *Ulnaris Internus*.

Muscles that move the four Fingers.

1. The *Extensor Digitorum Communis*,
2. The *Perforatus*, or *Sublimis*,
3. The *Perforans*, or *Profundus*,
4. The *Lumbricales*,
5. The *Interossei Interni*,
6. The ——— *Externi*,

1. The *Extensor Digitorum Communis* arises tendinous from the posterior and inferior part of the external condyle of the *os brachiale*, and descends externally along the forearm; being divided at its origin into three

⁽²⁴⁴⁾ *Flexor Carpi Ulnaris* of Innes.

⁽²⁴⁵⁾ *Flexor Carpi Radialis* of Innes.

fleshy parts, each of which ends in a tendon. All these three tendons pass together under the external carpal ligament, and over the back of the hand to the three first fingers; when they grow broad, and are joined together by means of numerous tendinous fibres. Each is extended over the back of the finger as far as to the base of the anterior phalanx, where they all disappear.

Sometimes this muscle passes into four tendons, and then one tendon goes to the little finger. These tendons, before they end, adhere to the other phalanges of the fingers, by means of fibres.

Their Use. They extend all the three phalanges of the fingers, and bend the last.

2. *The Perforatus, or Sublimis.* It arises from the internal condyle of the *os brachiale*, from the superior end of the cubit, from the middle of the *radius*, and from its interosseal ligament. The fleshy body passes into four parts, in the middle of the cubit, which are changed into as many tendons. These tendons pass together through the internal ligament of the *carpus*, and each goes over the palm of the hand to its corresponding finger. Before they come to the second phalanx of the fingers in which they end, they are perforated by the tendons of the *perforantes* muscles (²⁴⁶).

(²⁴⁶) *Flexor Sublimis Perforatus* of Innes.

Its *Use*. It bends the first and second phalanges inwards.

3. The *Perforans*, or *Profundus*, arises from the superior and middle part of the *ulna*, and from the interosseal ligament: it then passes into four tendons, which run under the internal interosseal ligament to the extremities of the anterior phalanges of the fingers. In this course, it perforates the muscles above it, as has been observed already. The tendon of this, and of the former muscle, runs in a membranous sheath, from the internal carpal ligament, and in the two first phalanges of the fingers, about the middle, being joined to their annular ligaments⁽²⁴⁷⁾.

Use. It bends the third phalanx of the fingers in particular, and the second and the first, inwards.

4. The *Lumbricales* are four, thin, small, oblong muscles, arising from the tendons of the *perforans*, under the carpal ligament; passing forwards to the fingers, and being implanted by means of a short tendon into the internal side of the first phalanx. They may be accounted as coadjutors of the former.

Their *Use*. They bend the phalanges of the first order towards the palm.

5. The *External* and *Internal Interosseal* Muscles occupy the spaces between the metacarpal bones. There are three external, and

(247) *Flexor Profundus Perforans* of Innes.

as many internal. The *External* fill the interstices of the metacarpal bones, on the back of the hand; they arise from the inferior part, and from the sides of the bones of the *metacarpus*; and they disappear in flat tendons, on the sides of the fingers, in such a manner, that the first is affixed to the external side of the middle finger, the second to its internal side, and the third to the external side of the little finger. The *Internal Interosseal Muscles* are rather placed upon, than between the metacarpal bones. They arise from the superior extremity of the metacarpal bones, to which they adhere; and they end in such a manner that the first is joined to the internal side of the fore-finger, the second to the external side of the ring-finger, and the third to the external side of the little-finger ⁽²⁴⁸⁾.

Their *Use*. Each of the *Internal Interosseal Muscles* bends its finger forwards towards the thumb, and somewhat inwards; if the finger be curved towards the palm, it is curved more by means of this muscle. Each of the *External Interosseal Muscles* bends its finger backwards, or draws it from the thumb, and bends it somewhat inwards: if the finger be already curved towards the palm, it is more curved, and drawn a little obliquely to one side by this muscle.

⁽²⁴⁸⁾ Innes enumerates four *External* and three *Internal Interosseal* muscles.

*Muscles that move the Fore Finger.*1. The *Extensor Indicis Proprius*,2. The *Abductor Indicis Proprius*.

1. The *Extensor Indicis Proprius* arises externally from the middle of the cubit, and at the inferior part of the cubit, from the interosseal ligament of the fore arm. Its tendon passes with the *extensor digitorum communis* under the external ligament of the wrist, and ends in the third phalanx of the fore finger.

Its Use. It extends the fore-finger only, when we point out any thing; it also bends the fore-finger outwards, and a little backwards towards the middle finger.

2. The *Abductor Indicis Proprius* arises from the superior part of the metacarpal bone, on its inside, by a fleshy beginning, runs towards the metacarpal bone of the fore-finger, adheres to it, and is connected by a broad tendon to the superior part of the first phalanx of the fore-finger. Sometimes it arises by a double tendon.

Use. It draws the fore-finger from the rest towards the thumb, and bends it somewhat towards the palm,

Muscles

Muscles that move the Little Finger.

1. The *Extensor Proprius Digiti Minimi*,
2. The *Abductor Digiti Minimi*,
3. The *Flexor Parvus Digiti Minimi*.

1. The *Extensor Proprius Digiti Minimi* arises by a long tendon from the external condyle of the *os brachiale*; runs fleshy outwards in the direction of the cubit as far as its middle, and ends in a long small tendon, which unites with the *extensor digitorum communis*, passes under the external carpal ligament with it, goes over the back of the hand to the little finger, and adheres to the phalanges of this finger, as the *extensor communis* in the other fingers.

Use. It extends the three phalanges of the little finger, and bends the first outwards.

2. The *Abductor Digiti Minimi* arises fleshy from the pisiform bone of the *carpus*, and from the internal transverse ligament of the *metacarpus*, terminates in a tendon, which unites with the tendon of the preceding muscle, and ends in the last metacarpal bone, and in the superior part of the first phalanx of the little finger.

Use. It draws the middle from the ring finger; and bends it, and its metacarpal bone, towards the palm.

3. The *Flexor Parvus Digiti Minimi* is small, and by many authors accounted only a part

part of the former; by others however it is called *Metacarpiacus*. It arises from the unciform bone of the *carpus*, and from the internal carpal ligament. Its end and insertion is common to it and to the former. In many instances, it is altogether absent; but, if it be present, it bends the first phalanx, and the whole little finger to the palm, towards the thumb.

Muscles that move the Thumb.

1. The *Abductor Pollicis*, or *Thenar*,
2. The ————— *brevis*,
3. The *Antithenar*, or *Opponens*,
4. The *Hypothenar*, or *Abductor Pollicis*,
5. The *Flexor Brevis Pollicis*,
6. The ——— *Longus* ———,
7. The *Extensor Minor Pollicis*,
8. The ——— *Major* ———.

1. The *Abductor Pollicis*, or *Thenar* arises tendinous from the external and almost the middle part of the cubit, and from the interosseal ligament; it passes from thence obliquely to the *radius*, which it surrounds, and is fixed to, at the metacarpal bone of the thumb: lastly, it disappears in a smooth tendon in the superior extremity of the last mentioned bone.

Its *Use*. It extends the metacarpal bone of the thumb, when bent towards the palm; it draws it somewhat backwards, and consequently

quently draws the thumb from the hand. A part of the tendon of this muscle is joined to the *abductor pollicis brevis*, and assists it in acting ⁽²⁴⁹⁾.

2. The *Abductor Pollicis Brevis* arises from the internal ligament of the *carpus*, and from the *os multangulum majus*; it passes straightly to the superior condyle of the first phalanx of the thumb, to which it is affixed by a part of its tendon. The other part goes over the articulation of this phalanx with the metacarpal bone, passes upon the back of the hand, and is connected with the tendon of the *extensor* muscle of the thumb.

Its *Use*. It removes the thumb from the hand, and draws it somewhat backwards.

3. The *Antithenar* arises from the first and second metacarpal bones, passes obliquely to the thumb, and is implanted in its first phalanx, by means of a strong tendon.

Its *Use* is to bend the thumb inwards, and to oppose it to the palm of the hand, and to the fingers.

4. The *Hypothenar* arises from the *os multangulum magnum*, and from the internal carpal ligament; it passes from this origin to the thumb, and is inserted, by means of a tendon, united with the tendon of the *flexor brevis pollicis* into the superior head of the first phalanx.

⁽²⁴⁹⁾ Albinus called the internal portion of the *abductor pollicis manus* by the name of *abductor brevis alter*.

Its Use. It draws the thumb inwards into the palm of the hand, and to the middle finger.

5. The *Flexor Brevis Pollicis* arises internally by tendinous fibres from the inferior part of the *os cuneiforme*, *os capitatum*, and *os multangulum minus*; also from the internal carpal ligament, and the adjacent heads of the metacarpal bones. It is inserted tendinous into the first and second phalanges of the thumb. Some of its tendinous fibres are joined with the *extensor major*, the *abductor brevis*, and the *abductor inferior* of the thumb.

Use. It bends the first phalanx of the thumb into the palm, and it draws its metacarpal bone backwards, and in some degree outwards.

6. The *Flexor Longus Pollicis*. As the fingers have a *perforans* muscle, so likewise the thumb has a *flexor*. It arises, like that, from the interosseal ligament of the fore-arm, and from the middle of the *radius*; it descends, on its inside, with the tendons of the *perforans* muscle of the fingers; it passes under the internal ligament of the *carpus*, turns towards the thumb, and ends in the superior part of the second phalanx.

Its Use. It bends the first and last phalanx of the thumb towards the palm.

7. The *Extensor Minor Pollicis* arises immediately under the *abductor longus pollicis* from the *ulna* and the interosseal ligament; it runs obliquely

obliquely towards the fore part of the inferior head of the *radius*, passing at that place, by its small, smooth tendon through the carpal ligament, it goes to the back of the hand, and joins the tendon of the *extensor pollicis major*. It ends sometimes by its tendon in the superior head of the first phalanx of the thumb.

Its Use. If it be united by its extremity to the tendon of the *extensor major*, it extends both phalanges of the thumb; but if it be connected by its tendon to the first phalanx of the thumb, it only moves the first phalanx.

8. The *Extensor Major Pollicis* arises, like the former, from the *ulna*, the interosseal ligament, and the external surface of the *radius*, by a broad, thin origin, but almost entirely cartilaginous; it descends a little obliquely, and is changed into a strong and nearly round tendon, which passes under the external carpal ligament, goes upon the back of the thumb, and, being generally united with the tendon of the *extensor minor*, it is attached to the external surface of the first phalanx of the thumb, near its base.

Its Use. It extends both phalanges of the thumb, and draws them outwards and backwards.

Muscles

*Muscles that move the Palm of the Hand.*1. The *Palmaris Brevis*,2. The ——— *Longus*.

1. The *Palmaris Brevis* is a small muscle, almost quadrangular, situated under the common integuments. It arises by means of a broad, aponeurotic membrane from the external surface of the internal carpal ligament near the thumb; also, from the beginning of the broad tendon of the *palmaris longus*. It passes a little afterwards into fleshy bundles, and these into an *aponeurosis*, that vanishes in the skin.

Its *Use*. It contracts the beginning of the palm, where it is situated, so as to make it hollow.

2. The *Palmaris Longus* arises by a short tendon from the internal condyle of the *os brachiale*, its body is small and fleshy, and generally passes into a long, slender tendon. It descends on the inside of the fore-arm, passes over the internal carpal ligament, to which it adheres, goes into the palm of the hand, and is expanded into an *aponeurosis*, that covers the whole palm, and is composed of four distinct parts, each of which runs to its finger, and is inserted into the internal part of the bones of the *metacarpus* and the base of the fingers. This *aponeurosis* defends the tendons, muscles, vessels and nerves of the palm.

Use.

Use. It contracts the skin of the palm.

Muscles of the Inferior Extremities.

The muscles that serve for the *Motion of the Lower Extremities* are divided, after the manner of the bones to which they belong, into those of the Thigh, those of the Leg, and those of the Foot.

Muscles of the Thigh.

For the motion of the thigh there are thirteen muscles; viz.

1. The *Psoas Magnus*,
2. The *Iliacus Internus*,
3. The *Pectineus*,
4. The *Triceps Femoris*,
5. The *Obturator Externus*,
6. The *Glutaeus Magnus*,
7. The ——— *Medius*,
8. The ——— *Parvus*,
9. The *Pyriformis*,
10. The *Obturator Internus*,
11. The *Gemellus*,
12. The *Quadratus Femoris*,
13. The *Musculus Fasciae Latae*.

1. The *Psoas Magnus* arises by a tendinous origin from the inferior margin of the last dorsal *vertebrae*, and of the four superior lumbar *vertebrae*, and from their transverse processes. It descends on the internal surface of the *os ilei*, becomes tendinous, and is joined with

with the *iliacus* muscle. United to this muscle, it passes between the anterior and inferior iliac spine, and the oblique eminence of the *os pubis* opposite it. Lastly, it passes under Poupart's ligament towards the smaller trochanter of the *os femoris*, to which it adheres.

Use. It raises the *os femoris* forwards, and draws it outwards.

2. The *Iliacus Internus* arises from the whole internal surface of the *os ilei*; its fleshy fibres are always contracted, and becoming tendinous are united to the *psoas magnus*, passing with it, as already observed, through Poupart's ligament, and ending in the small trochanter of the *femur*. There is often another small muscle arising from the inferior and anterior iliac spine, descending on its outside, and being inserted into the transverse line of the *os femoris* immediately below the *trochanter minor*. It is called by some the *Iliacus Parvus*.

Its *Use* is the same as that of the former.

3. The *Pectineus* arises from the acute line of the *os pubis*; it passes downwards and outwards, and terminates lastly in the rough line, below the small trochanter of the *os femoris* (²⁵⁰).

Use. It draws one thigh to the other, raises it, and turns its fore-part outwards.

(²⁵⁰) *Pectinalis* of Innes.

4. The

4. The *Triceps Femoris* consists of three distinct portions: hence, by some Anatomists, it is divided into three distinct muscles, viz.

1. Into the *Longus*,
2. ——— *Brevis*,
3. ——— *Magnus*, a muscle of the thigh passing inwards.

The *First* arises by a strong tendon from the anterior margin of the *os pubis*, near its *symphysis*. It goes downwards and outwards, towards the middle of the *aspera linea* of the *os femoris*, to which it is affixed ⁽²⁵¹⁾.

The *Second* arises immediately below the former from the *os pubis*, and ends in the *linea aspera* of the *os femoris*, above the tendon of the preceding ⁽²⁵²⁾.

The *Third* arises from the eminence, and the anterior surface of the *os ischii*; its fleshy fibres descend, in the way of the two preceding, and are connected to its *linea aspera*. When they all unite, they pass into a common tendon, which descends along the *femur*, and is joined posteriorly to the eminence of the internal condyle ⁽²⁵³⁾.

Use. The three muscles now enumerated bring one thigh inwards to the other.

⁽²⁵¹⁾ *Adductor Femoris Primus* of Douglas; *Triceps Minus* of Winslow; *Adductor Longus Femoris* of Innes.

⁽²⁵²⁾ *Adductor Femoris Secundus* of Douglas; *Triceps Secundus* of Winslow; *Adductor Brevis Femoris* of Innes.

⁽²⁵³⁾ *Adductor Femoris Tertius*, and *Adductor Femoris Tertius* of Douglas; *Triceps Tertius* of Winslow; *Adductor Magnus Femoris* of Innes.

5. The *Obturator Externus* arises externally from the anterior part of the *os ischii* and *pubis*, anteriorly from the external middle edge, and posteriorly from the inferior edge of the *foramen ovale* of the *ossa innominata*. Its fleshy fibres go somewhat transversely downwards between the inferior margin of the *acetabulum* of the thigh bone, and the ischiatic tubercle, through the notch placed there; they are terminated posteriorly on the inside, at the base of the great trochanter of the thigh.

Use. With the preceding, it bends the thigh inwards, and rolls it outwards:

6. The *Gluteus Magnus* is a broad, thick, and fleshy muscle. It arises rather fleshy than tendinous from one half of the posterior part of the external margin of the *os ilei*, from the external ischiatic ligament, where it is connected with the *longissimus dorsi*, the *latissimus dorsi*, and the *sacrolumbaris*; and from the external margin of the *os sacrum*, the posterior lateral part of the whole *os coccygis*, and lastly, from the internal surface of the broad *fascia*. This muscle, so broad at its beginning, grows by degrees narrow, passes obliquely downwards over the greater trochanter of the *os femoris*, till it becomes a thick, broad tendon, which is joined, on the external part of the thigh, with the *broad fascia*, and terminates, on the back of the thigh, about the breadth of four fingers below the great trochanter ⁽²⁵⁴⁾.

⁽²⁵⁴⁾ *Gluteus Maximus* of Innes.

Use. It raises the thigh backwards towards the spine, and rolls it a little outwards. It also draws one thigh, when turned over the other, from it.

7. The *Glutaeus Medius* is placed under the former. It arises from the whole external surface of the *os ilei*, and from its *superior crista*; its fibres, like those of the former, are contracted as they descend, and pass finally into a strong tendon, which ends in the posterior part of the great trochanter.

Its *Use.* It turns one of the thighs outwards from the other.

8. The *Glutaeus Parvus* is situated under the two former; it arises from the side of the whole external surface of the *os ilei*; its fibres pass in rays, become gradually smaller, and terminate by a short, round tendon, which is affixed anteriorly to the anterior margin of the great trochanter ⁽²⁵⁵⁾.

Its *Use.* It bends the thigh outwards, like the former.

9. The *Pyriformis*, so called from its figure, arises laterally from the *os sacrum*, and from the inferior and posterior adjacent part of the *os ilei*. It passes obliquely and a little downwards through the ischiatic notch, and ends by means of a long tendon in the cavity behind the great trochanter. It is at last united with the common tendon of the *obturator internus* and the *gemellus* ⁽²⁵⁶⁾.

⁽²⁵⁵⁾ *Gluteus Minor* of Albinus; *Gluteus Minimus* of Innes.

⁽²⁵⁶⁾ *Pyriformis*, or *Iliacus Externus* of Douglas.

Its *Use*. It draws the thigh outwards, when bent forwards, and it draws one thigh from the other, when turned inwards.

10. The *Obdurator Internus* fills up the *foramen ovale* of the *os innominatum* internally, as the *Obturator Externus* does externally. It arises by tendinous fibres from almost the whole circumference of the *foramen ovale*, and also from the ligament closing it. There is a small space between these tendinous fibres for the passage of nerves and vessels going out of the *pelvis* into the thigh. Its tendon passes through the notch, between the tuberosity and spine of the *os ischii*, is bent in this notch about the *os ischii*, and goes out of the *pelvis*, almost transversely, to the superior and internal part of the whole trochanter, to which it is fixed.

Use. It rolls the thigh, like the *pyriformis*.

11. The *Gemellus* is divided by some into the superior and inferior. It commonly arises by a double beginning externally from the spine and tuberosity of the *ischium*; it then divides into two, which again unite in one common tendon, which is joined with the *obturator internus*, and ends in the aforementioned cavity, behind the great trochanter ⁽²⁵⁷⁾.

Its *Use*. It assists the *obturator internus*.

12. The *Quadratus Femoris* is longer than broad. It arises from the external margin

(²⁵⁷) *Gemini* of Innes.

of the tuberosity of the *ischium*; its fleshy fibres go transversely to the thigh, and end in the line between the great and small trochanter.

13. The *Musculus Fasciae Latae*. This is a small, flat muscle arising tendinous from the outside of the anterior and superior spine of the *ilium*; it immediately becomes fleshy, and disappears by short tendinous fibres in the internal surface of the broad *fascia* ⁽²⁵⁸⁾.

The *Fascia Lata* is a strong aponeurotic membrane, arising from the external side of the superior *crista* of the *ilium*, from Poupart's ligament, from the ligament of the *obliquus externus abdominis*, and from the inferior part of the *os sacrum* and the great trochanter; it descends on the thigh, and includes all the muscles placed there. When it passes over the knee, it surrounds all the muscles of the leg, and ends in its extremity.

The Use of the *Musculus Fasciae Latae* is to stretch the *fascia*, and to draw the fore part of the thigh inwards.

Muscles of the Leg.

For the motion of the *Tibia* there are ten muscles, all which are included in the broad *fascia*.

1. The *Rectus Cruris*,
2. The *Vastus Externus*,

⁽²⁵⁸⁾ *Musculus Aponeurosis*, or *Fasciae Latae* of Winslow;
Tensor Vaginae Femoris of Innes.

3. The *Vastus Internus*,
4. The *Cruraeus*, or *Cruralis*; all which extend the leg,
5. The *Biceps Cruris*,
6. The *Semitendinosus*,
7. The *Semimembranosus*,
8. The *Gracilis*,
9. The *Sartorius*,
10. The *Popliteus*: which seven bend the leg.

1. The *Rectus Anticus Cruris* arises by a strong, double tendon; one part of which arises from the anterior and inferior spine of the *os ilii*, and another part from the superior margin of the *acetabulum*. From hence it descends anteriorly along the thigh, and is united inferiorly with the *Cruralis* muscle, but laterally with the *vasti* muscles. It is inserted, together with them, into the ham, and the anterior part of the ligament, by which the *patella* is joined to the *tibia*.

Its *Use* is to extend the knee, when bent.

2. The *Vastus Externus* arises from the anterior and external part of the great trochanter, at its base, where it unites with the *glutaeus magnus*. From hence it descends obliquely, covers almost the whole external side of the thigh, and is tied by a broad, thick, and short tendon, to the external margin of the *patella*, and to the anterior part of the superior condyle of the *tibia*. It is also joined to the ligament of the *patella* and the *fascia lata*.

Its *Use* is to extend the knee.

3. The

3. The *Vastus Internus* covers the whole internal part of the thigh, as the *vastus externus* covers the external part. It arises from the oblique eminence under the little trochanter, descends like the former, and is inserted, by means of a broad tendon, into the internal side of the *patella*. It joins the tendon of the *rectus anticus cruris*, and the *fascia lata*: and it is affixed by tendinous fibres on the internal side to the superior head of the *tibia*.

Its *Use* is likewise to extend the knee.

4. The *Cruraeus* arises anteriorly from the external part of the *os femoris*, and descends to the *patella*: and the fleshy fibres being changed into a tendinous nature, it is joined to the common tendon of the two *vasti*, and passes with these tendons into an *aponeurosis*, covering the *patella*; and, as was noticed above, affixed to the *tibia*.

Its *Use*. It concurs to extend the knee.

5. The *Biceps Cruris* is composed of two muscles, which unite at their insertion into one common tendon. One of them is longer than the other, and arises by a short, strong, and broad tendon, from the tuberosity of the *ischium*, joining at this place with the *semitendinosus*. The short muscle arises, commonly in the middle of the thigh, from the *linea aspera* conspicuous on its posterior part. They both descend a little outwards, and, becoming tendinous, pass into a strong, flat, short, tendon, which is affixed to the external side of the superior head of the *fibula*.

Use. It bends the knee backwards; and when the knee is bent, it rolls the *tibia* outwards, its anterior part being previously turned inwards.

6. The *Semitendinosus* is so called, because its inferior middle part is composed entirely of tendon. It arises by a small, thick, tendon, from the tuberosity of the *os ischii*: it is united to the longer part of the *biceps cruris*, and terminates afterwards in a long, thick, flat, tendon, which descends posteriorly along the *femur*, and is united to the internal surface below the head of the *tibia*, immediately under the *gracilis* ⁽²⁵⁹⁾.

Its *Use* is to bend the knee backwards. When the knee is bent, it moves the *tibia* inwards, its anterior part being previously turned outwards.

7. The *Semimembranosus* is so called, because its inferior middle part is formed only of a broad membranous tendon. It arises by a long, thick, and almost round tendon, from the superior part of the tuberosity of the *os ischii*, descends along the thigh, and adheres posteriorly immediately under the internal head of the *tibia* ⁽²⁶⁰⁾.

Its *Use* is the same as that of the *semitendinosus*.

8. The *Gracilis* is a long, thin, muscle, arising at the *symphysis pubis* from the ligament

⁽²⁵⁹⁾ *Seminervosus* of Winslow and Douglas.

⁽²⁶⁰⁾ The *Semitendinosus*, and *Semimembranosus* form what is called the *Inner Ham-string*. The Tendon of the *Biceps Cruris* is the *Outer Ham-string*.

that connects these bones ; and below it from the margin of the *os pubis*. From hence it descends on the inside of the thigh to the superior head of the *tibia*, and ends anteriorly on the inside of its head, near the spine of the *tibia* ⁽²⁶¹⁾.

Its *Use* is to bend the knee backwards : and, when the knee is bent, to roll the *tibia*, in such a manner, that the anterior part of the bottom of one foot is turned to the other foot.

9. The *Sartorius* is almost the longest muscle in the body : it arises by a small tendon from the anterior and superior spine of the *ilium*, passes obliquely over all the muscles on the anterior part of thigh, goes to the inside of the knee, and there becoming tendinous, is inserted by its broad tendon under the interior head of the *tibia*.

Its *Use*. It bends the knee backwards, and rolls the *tibia* in such a manner that the anterior part of the bottom of one foot is turned to the other foot, and that, when we sit, we may put one thigh over the other, like a taylor.

10. The *Popliteus* is placed obliquely under the ham. It arises by a short small tendon from the external condyle of the thigh, passes over the capsular ligament obliquely, adheres to it, goes inwards, and ends on the posterior surface of the superior extremity of the *tibia*.

Its *Use*. It rolls the *tibia*, when the knee is bent, in such a manner that the anterior part of the bottom of one foot is turned to the other.

(²⁶¹) The *Gracilis Internus*, or *Rectus Internus* of Winslow.

Muscles of the Foot.

For the *motion of the Foot* there are eight muscles, connected not only to the *tarsus* but also to the bones of the *metacarpus*: viz.

1. The *Gemellus*, or *Gastrocnemius*,
2. The *Soleus*,
3. The *Plantaris*:

These three extend the foot.

4. The *Tibialis Anticus*,
5. The *Peroneus Tertius*:

These two bend the foot.

6. The *Tibialis Posticus*,

This turns the foot inwards.

7. The *Peroneus Longus*,
8. The ——— *Brevis*:

These two turn the foot outwards.

1. The *Gemellus*, or *Gastrocnemius*. Under this denomination come two thick, broad, muscles, oblong, separate at their origin, but united at their insertion, constituting one digastric muscle. They arise almost entirely tendinous posteriorly and laterally, immediately above the condyles of the *os femoris*; so that one passes on the outside, and the other on the inside. The two fleshy bodies of these muscles unite under the calves of the legs, and form a common, broad, strong, tendon; which, joined to the tendon of the *soleus* muscle, forms the very thick, strong, tendon, called *Tendo Achillis*. This descends towards the heel, becomes smaller, and again becomes expanded,

expanded, ending in the posterior surface of the heel ⁽²⁶²⁾.

Use. They elevate the *os calcaneum*, draw the bottom of the foot backwards, and extend the bottom of the foot.

2. The *Soleus* arises, by a broad, double, tendinous origin, from the posterior part of the *tibia* and *fibula*. It adheres to the posterior margin of the internal spine of the *tibia* beyond the middle of this bone: it becomes less in its descent, unites with the tendon of the *gastrocnemius* to form the *Tendo Achillis*. Its action is like that of the *gastrocnemius* ⁽²⁶³⁾.

3. The *Plantaris* arises by a small, flat, tendon, from the external condyle of the *femur*: it passes into a fleshy body, which is soon changed into a long, thin, small, tendon, that descends between the *soleus* and *gastrocnemius*, is united to the common tendon, and fixed externally to the posterior surface of the *os calcaneum* ⁽²⁶⁴⁾.

Its *Use* is the same as that of the former.

4. The *Tibialis Anticus* arises superiorly beneath the condyle of the *tibia*, from its external surface: it descends along it, and passes into a strong tendon, which goes through the transverse ligament of the *tarsus*, and is connected by means of a double extremity, not only to the superior convex surface of the first

⁽²⁶²⁾ *Gastrocnemius Externus*, or *Gemellus* of Innes.

⁽²⁶³⁾ *Extensor Tarfi Suralis*, or *Extensor Magnus* of Douglas: *Gastrocnemius Internus*, or *Soleus* of Innes.

⁽²⁶⁴⁾ *Extensor Tarfi Minor*, vulgò *Plantaris* of Douglas.
cuneiform

cuneiform bone, but likewise to the base of the first metatarsal bone.

Its *Use*. It raises the anterior part of the bottom of the foot, and of course bends it.

5. The *Peroneus Tertius* arises from the middle of the *fibula*: its tendon passes through the transverse ligament of the *tarsus*, and ends in the posterior and superior part of the fifth metatarsal bone ⁽²⁶⁵⁾.

Its *Use* is to concur with the former in bending the bottom of the foot.

6. The *Tibialis Posticus* arises fleshy superiorly from the posterior part of the *tibia* and *fibula*, immediately below the articulation of these bones with each other. It descends fleshy, and passes into a tendon that runs behind the internal angle to the bottom of the foot; where it is divided into numerous portions, and attached on the inside of the foot to the *os naviculare*, and to the posterior and inferior part of the first and third cuneiform bone of the *tarsus*, and not uncommonly to the inferior part of the third metatarsal bone.

Its *Use*. It raises the bottom of the foot obliquely inwards and backwards: hence, it rolls the bottom of the foot inwards and backwards.

7. The *Peroneus Longus* arises superiorly from the outside of the *fibula*, descends with it, and passes tendinous behind the external

⁽²⁶⁵⁾ *Nonus Vesalii.*

anle, through the ligament that is common to it, and the *peroneus brevis*, into the sole of the foot, where it disappears on the inside of the first metatarsal bone⁽²⁶⁶⁾.

Its *Use*. It rolls the sole of the foot outwards, and somewhat backwards.

8. The *Peroneus Brevis* arises anteriorly from the middle of the *fibula*, becomes tendinous soon afterwards, goes with the tendon of the former through the ligament common to both, and is inserted into the convex surface of the fifth metatarsal bone⁽²⁶⁷⁾.

Its *Use*. It acts like the former.

Muscles of the Toes.

1. The *Extensor Longus Digitorum Pedis*,
2. The ——— *Brevis* ———— ———,
3. The *Flexor Longus*, or *Perforans Digitorum Pedis*,
4. The ——— *Brevis*, or *Perforatus Digitorum Pedis*,
5. The *Lumbricales*,
6. The *Interossei Inferiores*,
7. The ——— *Superiores*.

1. The *Extensor Longus Digitorum Pedis* arises from the anterior part of the interosseal ligament, and from the inferior and anterior part of the *tibia*, and the internal part of the *fibula*. It descends along these bones, passes obliquely forwards through the transverse ligament of the *tarfus* to the back

⁽²⁶⁶⁾ *Peroneus Primus*, or *Posticus* of Douglas.

⁽²⁶⁷⁾ *Peroneus Secundus*, or *Anticus* of Douglas.

of the foot; and is there divided into four tendons, which end on the superior convex surfaces of the four small toes (²⁶⁸).

Its *Use*. It extends the phalanges of the toes, into which it is inserted, and elevates the first phalanx.

2. The *Extensor Brevis Digitorum Pedis* arises from the external and superior part of the *os calcaneum*, goes obliquely inwards over the back of the foot, and is divided there into four portions, each of which is changed into a small, smooth, long tendon. The first, and largest of these tendons adheres to the superior surface of the first phalanx of the great-toe; the three others, united to the tendons of the *extensor longus*, are inserted into the phalanges of the three next toes (²⁶⁹).

Use. It extends the toes.

3. The *Flexor Longus*, or *Perforans*, arises from the middle of the posterior part of the *tibia*, and from the interosseal ligament; becoming tendinous, it passes behind the internal angle to the *calcaneum*, to which it adheres by means of a particular ligament; and where it is joined by a bundle of fleshy fibres coming from the *calcaneum*, which are taken by some for the *True Plantar Muscle*. From this ligament it passes obliquely forwards and outwards to the middle of the sole of the foot, and is there divided into four

(²⁶⁸) *Extensor Longus* of Douglas.

(²⁶⁹) *Extensor Brevis* of Douglas.

parts; these parts go through the fissures of the four tendons of the *perforatus*, and are implanted in the third phalanx of the four small toes ⁽²⁷⁰⁾.

Use. It bends all the three phalanges of the four small toes downwards.

4. The *Flexor Brevis*, or *Perforatus Digitorum Pedis* is placed under the plantar aponeurosis: it arises from the inferior surface of the *calcaneum*, covers the sole of the foot, and adheres to the heads of the *metatarsal* bones. It arises from the inferior and internal surface of the *calcaneum*, and, like the former, passes into four tendons, which are divided, at their extremity, for the passage of the tendons of the *perforans*. Lastly, these tendons are inserted into the internal surface of the middle phalanx of the four small toes ⁽²⁷¹⁾.

Use. It bends the second and first series of phalanges of the four small toes downwards.

5. The *Lumbricales* are four small, thin muscles, very like the *lumbricales* of the hand. They arise from the tendon of the *perforans*, and adhere by means of small tendons to the inferior and posterior part of the first phalanx of the four small toes, where they are joined by tendons with the *perforans*.

⁽²⁷⁰⁾ *Flexor Longus Digitorum Pedis, Profundus, Perforans* of Innes.

⁽²⁷¹⁾ The *Perforatus*, or *Sublimis* of Douglas; the *Flexor Brevis Digitorum Pedis, Perforatus, Sublimis* of Innes.

Use.

Use. They bend the first phalanges of the four toes towards the sole of the foot, and also obliquely forwards.

6. The *Interossei Inferiores*, three in number, fill the space between the metatarsal bones in the sole of the foot, as the *Superiores* do in the back of the foot. They arise by thin, small tendons, in such a manner, that the first, arising in the longitudinal direction of the inferior, internal part of the third metatarsal bone, terminates on the inside of the first phalanx of the third toe; the second, arising from the internal and inferior part of the fourth metatarsal bone, is inserted into the internal part of the first phalanx of the fourth toe; and the third, arising from the internal and inferior part of the fifth metatarsal bone, is inserted by means of a long, broad tendon, into the internal part of the first phalanx of the little toe.

Use. They draw the first phalanx of the four little toes towards the great toe, and backwards.

7. The *Interossei Superiores* are four in number; the first arising inferiorly from the sides of the first metatarsal bone, and superiorly from the second metatarsal bone, and ending in the inside of the first phalanx of the second toe; and the other three arising from the inside of the three last metatarsal bones, and from the outside of the second, third, and fourth metatarsal bone, and ending by
small

small tendons in the outside of the first phalanx of the toes.

Use. They draw the first phalanx of the four small toes from the great toe, and a little backwards.

Muscles that move the Great Toe.

1. The *Extensor Proprius Pollicis Pedis*,
2. The *Flexor Longus Pollicis Pedis*,
3. The ——— *Brevis* ——— ———,
4. The *Adductor Pollicis Pedis*,
5. The *Transversalis Pedis*,
6. The *Abductor Pollicis Pedis*.

1. The *Extensor Proprius Pollicis Pedis* arises anteriorly from the internal and middle part of the *fibula*, from the interosseal ligament, and sometimes from the *tibia* itself; becoming fleshy, it passes, like the *tibialis anticus*, through the transverse ligament of the *tarsus*, and ends on the back of the external phalanx of the great toe. This tendon sends off, on both sides, a broad, thin, aponeurotic membrane, that exactly covers the phalanges of the great toe (²⁷²).

The Use. It extends the first and last phalanx of the great toe, and bends them backwards.

2. The *Flexor Longus Pollicis Pedis* arises posteriorly from the middle and inferior part of the *fibula*, descends tendinous obliquely behind the internal angle into the sole of the

(²⁷²) *Extensor Longus* of Douglas.

foot, and ends in the inferior part of the first and last phalanx of the great toe (²⁷³).

Use. It bends the first and last phalanx of the great toe downwards.

3. The *Flexor Brevis Pollicis Pedis* arises by a broad, but thin tendon from the bottom of the third cuneiform bone, and sometimes from the *os cuboides* of the *tarsus*; it runs directly to the beginning of the great toe, and is inserted by one part of its tendon into the *ossa sesamoidea*, between the great toe and the bones of the *metatarsus*, and by the other part into the first phalanx of the great toe. It is likewise joined to the tendon of the *abductor* and *adductor* of the great toe.

Use. It bends the first phalanx of the great toe downwards.

4. The *Adductor Pollicis* arises tendinous from the inferior part of the fourth, third, and sometimes of the second metatarsal bone, and from the tendon of the *peroneus longus*; it passes to the great toe, and is inserted by its tendon into the posterior and inferior part of the internal sesamoid bone, and the first phalanx of the great toe. The tendon of this muscle is united with the former and with the *transversalis pedis* (²⁷⁴).

5. The *Transversalis Pedis* arises generally by a broad, very thin tendon from the anterior extremity of the fifth metatarsal bone, and partly from the plantar *aponeurosis*; it

(²⁷³) The *Flexor Longus* of Douglas.

(²⁷⁴) The *Antithenar* of Winslow.

passes across the sole of the foot, and is inserted into the sesamoid bone, at the insertion of the *adductor pollicis*, to the extremity of which it is united.

Use. When it acts, it renders the anterior part of the sole of the foot, over which it runs, hollow; because, it draws the great toe to the posterior toes, and these to the great toe.

6. The *Abductor Pedis* arises by broad, thin tendons from the *calcaneum*, the *os naviculare*, and *os cuneiforme*: these tendons, all of them, unite into a muscle, which ends by a long, thick, and flat tendon on the anterior extremity of the first metatarsal bone, and on the posterior part of the first phalanx of the great toe ⁽²⁷⁵⁾.

Use. It draws the great toe from the rest; and it concurs, with the rest, to bend the bottom of the foot inwards and downwards.

Muscles that move the Little Toe.

1. The *Flexor Brevis Digiti Minimi Pedis*,
2. The *Abductor Digiti Minimi Pedis*.

1. The *Flexor Brevis Digiti Minimi* arises tendinous from the inferior and posterior part of the last metatarsal bone; and is inserted into the posterior, inferior part of the first phalanx of the little toe; and into the external margin of the inferior surface of the last metatarsal bone ⁽²⁷⁶⁾.

⁽²⁷⁵⁾ The *Thenar* of Winslow.

⁽²⁷⁶⁾ The *Parathenar Minor* of Winslow.

Use. It bends the last phalanx of the little toe downwards.

2. The *Abductor Digiti Minimi Pedis* arises tendinous from the whole external surface of the *calcaneum*, runs to the fifth bone of the *metatarsus*; and ends by means of a small tendon outwards, in the superior extremity of this bone, and in the basis of the first phalanx of the little finger ⁽²⁷⁷⁾.

Use. It bends the little toe, and the metatarsal bone, downwards; and it draws the little toe from the rest.

The Abdominal Muscles.

The Muscles, that encircle the abdomen, are called the *Abdominal Muscles*.

There are ten, on each side:

1. The *Obliquus Externus Abdominis*,
2. The ——— *Internus* ———,
3. The *Transversus Abdominis*,
4. The *Rectus Abdominis*,
5. The *Pyramidalis*.

1. The *Obliquus Externus Abdominis* is a broad, thin muscle, fleshy posteriorly at its origin, and terminating anteriorly and inferiorly in an *aponeurosis*. It arises superiorly, but somewhat laterally from the eight, or nine lowest ribs, by eight or nine fleshy digitations; the four uppermost are united with four digitations of the *serratus major anticus*, the

⁽²⁷⁷⁾ The *Parathenar Major*, and *Metatarsus* of Winflow.

inferior are united with the digitations of the *serratus inferior* and *posticus*, and with the *latissimus dorsi*. It then passes obliquely downwards and forwards, is connected anteriorly to the *linea alba*, through its whole length; and terminated at the *crista* of the *ileum*, and anteriorly at the *os pubis*, by means of a tendon, which is joined with the tendon of the opposite *obliquus externus*, so that the tendinous parts of these two muscles decussate each other at the *os pubis*. These tendons are then divided inferiorly, on each side of the *abdomen*, so that in men the spermatic vessels, and in women the round ligaments of the *uterus* pass through the division from the cavity of the *abdomen*.

This fissure is called the *Abdominal Ring*, and it is the seat of inguinal *herniae*. Below this ring, the muscle is joined with the *transversus abdominis*, forming with it a tendinous ligament, which is attached to the inferior spine of the *ilium*, and anteriorly to the *os pubis*; called the *Inguinal Ligament of Fallopius*, or of *Poupart*. The muscle descends below this, and is joined to the *fascia lata*. Under this ligament run the tendons of the *psoas magnus* and *iliacus internus*, and the crural arteries, veins, and nerves. This is the seat of femoral *herniae* ⁽²⁷⁸⁾.

2. The *Obliquus Internus* is placed under the former. It arises by tendinous fibres from

⁽²⁷⁸⁾ *Obliquus Descendens* of Douglas; *Obliquus Descendens Externus* of Innes.

the transverse and spinous processes of the three or four inferior lumbar *vertebrae*, from the superior part of the *os sacrum*, and from the whole superior and anterior margin of the *os ilei*. It ascends from hence forwards and obliquely upwards; and is affixed to the inferior margin of the cartilaginous part of all the spurious ribs, and of the two lowest true ribs, as far as the *sternum* and xyphoid cartilage. Anteriorly it passes into a firm *aponeurosis*; the superior and inferior part of which is single, and is first inserted into the *linea alba*, over the *rectus abdominis*, and then separated into two layers, one of which goes over the *rectus*, and the other under it, to the *linea alba*, where they again unite, and disappear in the *linea alba*, and *os pubis* ⁽²⁷⁹⁾.

3. The *Transversus Abdominis* arises posteriorly tendinous from the transverse and spinous processes of the four last lumbar *vertebrae*; inferiorly from the internal *labium* of the superior and anterior margin of the *os ilei* and *os pubis*; and superiorly from the internal surface of all the false ribs, and of the two last true ribs. It goes to the xyphoid cartilage. The tendinous fibres of this muscle then go anteriorly into a broad tendon, which adheres to the *aponeurosis* of the *obliquus internus*, and ends in the *linea alba* ⁽²⁸⁰⁾.

⁽²⁷⁹⁾ *Obliquus Ascendens* of Douglas; *Obliquus Ascendens Internus* of Innes.

⁽²⁸⁰⁾ *Transversalis* of Innes.

From the union of the tendons of these three muscles arises that aponeurotic expansion in the middle of the abdomen, called *Linea Alba*.

4. The *Rectus Abdominis* is of the breadth of three fingers, situated in the middle of the abdomen, in the course of the *linea alba*. It arises from the xyphoid cartilage, and from the three last true ribs, and the first false rib, by means of different processes or digitations. It descends hence inferiorly in the *linea alba*, and is connected by a broad tendon to the thin, internal *labium* of the superior margin of the *os pubis*.

It must be observed particularly of this muscle, that it has three or four tendinous, broad lines, from its origin to the *umbilicus*, and often below it, called the *Tendinous Inscriptions of the Rectus*. These inscriptions pass directly across the fibres of this muscle. The *Vagina* of the *rectus* adheres to these intersections, or transverse lines, which seem intended to render the muscle stronger.

5. The *Pyramidalis*, the smallest of all the abdominal muscles, is situated inferiorly in the middle. It arises from the anterior and superior part of the *os pubis*, and is contracted the more as it ascends the higher, forming, as it were, a pyramid. Lastly, it disappears in the *linea alba*, by a tendinous extremity, and sends very many tendinous fibres into the *rectus abdominis*. This muscle is often wholly absent. Sometimes only one is pre-

sent; this being then firmer and in the middle. If however both be wanting, then the *rectus* grows wide and thick inferiorly, to supply its place.

Use. The five abdominal muscles constrict the *abdomen*, press all its contents, and promote the excretion of *foeces*, urine, and the expulsion of the *foetus* and *placenta*. When they compress the abdominal *viscera*, they drive the diaphragm upwards, lessen the cavity of the thorax, and compress the lungs. They likewise variously assist the motions of the body.

The Diaphragm deserves to be mentioned among the muscles of the *abdomen*, as it renders its superior part narrower, and presses the abdominal *viscera* downwards, and consequently the five muscles here mentioned outwards.

Muscles of the Anus.

There are three pair of muscles belonging to the *anus*, viz.

1. The *Levatores Ani*,
2. The *Transversus Perinaei*,
3. The *Sphincter Ani Internus*,
4. The ————— *Externus*.

The *Levator Ani*, or *Musculus Ani Latus*, is a broad, thin muscle, arising by a tendinous origin from the spine of the *os ischii*, and from the contiguous internal surface of the same bone, and from the internal part of the *os ilei*, at its connection; and anteriorly from

from the internal and uppermost part of the *os pubis*. The fleshy fibres descend to the posterior part of the *rectum*, where they unite with the *os coccygis* and the *sphincter ani internus*; thus covering the *rectum* posteriorly, and covering in man, the urinary bladder, the spermatic gland and *vesiculae spermaticae* anteriorly, and in women a part of the *vagina uteri*.

Use. When both act at once, they draw the posterior part of the *rectum* forwards, and raise it, lest it should descend in evacuating the *foeces*. It likewise seems to compress the spermatic gland, the bulb of the *urethra*, and the *vesiculae seminales*.

The *Sphincter Ani Internus* is an oblong, fleshy, strong, thick ring, consisting of the orbicular fibres of the *rectum*, surrounding the orifice of the *anus*, and closing it ⁽²⁸¹⁾.

The *Sphincter Ani Externus* is a broad, thin, fleshy muscle, composed of two bundles of fibres, running from the sides, and uniting both anteriorly and posteriorly; posteriorly and superiorly by acute angles to the fleshy membrane adhering to the *os coccygis*, and anteriorly and inferiorly to the membrane of the *rectum*, and at the middle and sides to the *acceleratores* implanted in the bulb of the

⁽²⁸¹⁾ The *Transversus Perinaei* is described among the muscles of the *Penis*.—This *Sphincter Internus*, as it is called by Albinus, Douglas, and Leber, is nothing more than the circular fibres of the *rectum* itself.

urethra. It is joined by means of numerous fibres with the *sphincter internus*, and in women with the *sphincter vaginae* ⁽²⁸²⁾.

Its *Use*. The orifice of the *anus* is closed and constricted by this muscle, lest the *foeces* should be discharged continually; and lest any thing should enter into the *rectum*.

The Sphincter Vesicae.

This belongs to the urinary bladder. It consists of a *fascia* of fleshy fibres, arising in men from the *sphincter ani*, but in women from the *sphincter vaginae*, and being fastened to the neck of the bladder, on every side, constricting it, and preventing the urine from escaping.

Hither we may also refer those fleshy fibres, which contract the urinary bladder, and diminish its cavity. These however are described in the Splanchnology.

The Cremaster Testicularum.

This belongs to the *Testes*. It arises, one proper to each of the *testes*, from the separating fibres of the *obliquus internus abdominis*, and from its tendon called Poupart's Ligament; it descends, with the spermatic vessels into the *scrotum*, and is there expand-

⁽²⁸²⁾ The *Sphincter Cutaneus* of Winslow; the *Sphincter Ani* of Innes.

ed into a *vagina*, by which the *testis* is covered, first posteriorly, but afterwards on all sides. By this muscle it is also compressed, elevated, and evacuated ⁽²⁸³⁾.

Some Anatomists refer hither a fleshy covering of the *scrotum*; but this covering is not flesh, but condensed cellular membrane, which cannot properly be considered here.

Muscles of the Penis.

1. The *Erectores*, or *Ischio-cavernosi*,
 2. The *Transversus Perinaei Primus*,
 3. The ————— *Secundus*,
 4. The *Acceleratores*,
 5. The *Compressor Prostatæ*.
1. The *Erectores Penis* arise from the tu-

⁽²⁸³⁾ Mr. Hunter proposes a new name for this muscle, in animals that undergo a change in the situation of their *testes*: he says, it should be called *Musculus Testis*.

Mr. Hunter remarks that the position of this muscle is very different in the *foetus*, and in the adult. Its situation in the *foetus* being the same as in animals, the testes of which remain through life in the cavity of the *abdomen*. Consequently, he concludes that the same purposes are answered by this muscle in the human *foetus* as in those animals (Obs. on certain Parts of the An. Oec.).

Mr. Hunter mentions this muscle as coming in part from the *Transversus abdominis*. Wrisberg however declares that he could never discover any part of it having such an origin (*De Testiculorum Descensu*, &c. p. 44. n. 2.).

berosity

berosity of the *ischium*, under the *corpora cavernosa penis*; they ascend forwards and inwards, and they are implanted in the *corpora cavernosa*. From this position it is clear, that the *erectores* are not intended to erect the *penis*, as some writers imagined, but that they rather draw the *penis* downwards from the bones of the *pubis*, and retain it in a middle situation between the perpendicular and the horizontal⁽²⁸⁴⁾.

2. The *Transversus Perinaei Primus* arises by a small, thin tendon from the tuberosity of the *ischium*, runs to the origin of the *erectores penis*, or *clitoridis* in women, becomes fleshy, and is joined, at the *os ischii*, with the *erector penis*, and is inserted into the middle of the bulb of the *urethra*, and goes into the *accelerator*.

Use. It constricts the bulb of the *urethra*; agitates it, and draws it backwards.

3. The *Transversus Perinaei Alter* arises also from the tuberosity of the *ischium*, and ends before the bulb in the *urethra*.

Its *Use* is to dilate the *urethra*.

4. The *Acceleratores* arise, on both sides, from the *corpora spongiosa*, surround the *urethra*, and unite in the inferior, middle part of the bulb. They are united likewise posteriorly with the *sphincter ani* ⁽²⁸⁵⁾.

Use.

⁽²⁸⁴⁾ *Ischio-cavernosi* of Winslow.

⁽²⁸⁵⁾ Mr. Hunter says—"I call these muscles *Expulsores Seminis*, as I apprehend their real use to be for the

Use. When these act, they compress the bulb, agitate it, and draw it backwards.

In old men, in whom these muscles are debilitated, the last drops of urine are never totally expressed from the bulb. Hence, art is forced to supercede nature.

5. The *Compressor Prostaticae* arises from the internal surface of the *os pubis*, between the bottom of the *symphysis* and the *foramen magnum*. This thin muscle being inflected, runs backwards, embraces the prostate, and either disappears in its inferior part, or is joined with its fellow of the opposite side.

The Constrictor Cunni.

This muscle is proper to the *vagina*. It arises, on both sides, from the *sphincter ani*; it is augmented by a bundle of fleshy fibres coming from the *os ischii*; it passes forwards in the direction of the *labia vulvae*, and it is implanted in the *crura clitoridis*.

the expulsion of that secretion." He acknowledges however that they compress the bulb, and evacuate the last drops of urine; but—"if a receptacle had not been necessary for the *semen*, those muscles had probably never existed, and the last drops of urine would have been thrown out by the action of the bladder and *urethra*, as in some measure is the case in the castrated animal" (Obs. on certain Parts of the An. Oec. p. 39.).

In the lateral operation for the stone, the incision is made between this and the *Erector Penis*.

Use.

Use. When it acts, it compresses the sides of the *vagina*, and thus renders it narrow.

The Eretores Clitoridis.

One of these arises, on each side, from the *os ischium*, and ends in the *corpus spongiosum* of the *clitoris*.

Their **Use** is like that of the *Eretores Penis*.

ANGIOLOGY.

Of the Vessels in general.

ALL the vessels of the human body are either *Sanguiferous*, or *Lymphatic*; we shall treat of the latter in a proper section.

Vessels are distinguished into *Arteries* and *Veins*.

An *Artery* is a membranous, flexible, conical, vibrating canal, extended throughout the body in innumerable ramifications, and destined to carry blood from the heart to every part of the body.

A *Vein* is a flexible, conical, membranous, but not vibrating ⁽²⁸⁶⁾ canal, intended to carry back blood to the heart, from every part of the body.

The *Figure* of the arteries and veins is somewhat like that of a cone; the basis of both

⁽²⁸⁶⁾ There is no beating of the veins, except the *vena cava* near the heart, and the jugular veins of dying animals. The beating of the arteries, which continues during life, is called the *pulse*. All the arteries, large and small, are dilated at once; though, in the small arteries, the pulsation is not perceivable.

being in the heart, and the apex in the most remote parts of the body (²⁸⁷).

The

(²⁸⁷) That a section of the arteries, as well as of the veins, is circular, is now generally believed. It may be right to know also whether they be conical. Haller well deserves to be studied on this head (*Elem. Phys. Tom. I.*). Marherr would not absolutely call them cones; he only allowed them to be *ad sensum conoidei* (*Prael. in H. Boerb. Inf. Med. § 132.*); because whenever an artery runs for some length, without giving off any branches, it is found to be cylindrical in that course.

Another reason against their being conical is that the cavity of all the branches is greater than that of the principal trunk, or *aorta*. Haller says if the divisions from the *aorta* to the least artery in the whole body be supposed to amount only to twenty, yet the proportion of all the branches to the *aorta* will be more than 20 to 1. The arteries may nevertheless be called *seemingly conical*, *ad sensum conoidei*.

Another reason against our calling arteries converging cones, is that all the arteries in the human body, wherever they are branched out, are always a little dilated above the division (*Edinburgh Med. Essays, Vol. 5. p. 806. Haller, Elem. Phys. Tom. I.*).

Moreover, some arteries are of larger diameter as they are farther from the heart; as the spermatic artery (*Monro, De Testibus et Semine.*): and the capillary arteries are necessarily cylindrical, because of the frequent anastomoses of their net-work.

Of the *Branches of Arteries* it may be asked, how often they divide, while they retain their name? Dr. Keil says 40 or 50 times. Haller scarcely ever found 20 divisions.

The *Strength of the Arteries* increases inversely as their diameter decreases: or, the smaller the arteries are, the stronger they are also; that is, with respect to the contained blood. Hence, the force of the blood is greater against the *aorta*, at the heart, than in any other part of the body, the branches being always stronger than their respective trunk. Hence, aneurysms happen so often in the *aorta* (*Clifton Winttingham's Experimental Inquiry* on

The *Arteries* therefore carry the blood from a basis to an apex ; but the *Veins* from an apex to a basis.

The Arteries are composed of the following *Membranes* or *Coats*.

1. An *External* coat always arising from the cavities through which the arteries pass ; in the head the external coat is derived from

on some parts of the Animal Structure.). The reason is clear ; for the proportion of containing solid, to the contained fluid, increases in the inverse ratio of the diameters ; so that the strength increases in the same ratio.

The diameters of two branches are always greater than that of their trunk, each branch being always less than its trunk, except the coronary, phrenic, spermatic, &c. arteries (Marherr.).

No artery in the body is straight, not the inter-osseal, nor the tibial, perinaeal, radial, ulnar, &c. or if any do pass in a straight course, it is soon inflected. The uses of which seem to be chiefly, for containing more blood in a given space, for lessening the *impetus* of the blood flowing into parts, and to prevent those effects, which must otherwise happen in parts liable to much motion. Anatomists however frequently draw them, as if they were straight (Haller, *Elem. Phys.*). Perhaps, in the *systole*, arteries are straight, which become contorted in the *diastole*.

Much has been said by Physiologists respecting the angles which the arterial branches make with their trunks. They ofteneft make an acute angle, or approach somewhat to a right angle. They seldom form a right angle, and very seldom an obtuse angle. Haller says that the only obtuse, or real right angles are at the origin of the spinal arteries, of the inferior arteries of the *cerebellum*, and of the coronary arteries (*Elem. Phys.*). The reason is evident ; an acute angle being the fittest, in projectile motion, to throw bodies to a great distance.

An *Anastomosis* is formed by two trunks directly uniting, or being united by means of an intermediate branch (Haller, *Elem. Phys.*).

the *dura mater*; in the *thorax* from the *mediastinum*; in the *abdomen* from the *peritoneum*.

2. The *Cellular* coat, which is next to the external, loosely encircles the arteries; it is often filled with fat in the large arteries, and serves to sustain the vessels which nourish the arteries.

3. The third coat, which is *Muscular*, is composed of fleshy fibres, which being like arcs, many of them peculiarly disposed, constitute the whole circumference of an artery.

4. This coat consists of cellular membrane, which adheres firmly to the muscular coat.

5. The last coat is the *Internal*; it is of a white colour, a firm texture, and has a very smooth surface.

These coats have arteries by which they are nourished, and veins, and nerves ⁽²⁸⁸⁾.

The *Origin* of all the arteries is either from

⁽²⁸⁸⁾ These small arteries and veins, which may often be seen in the recently dead body, and may often be filled with a coloured liquor from the trunks on which they ramify, are known by the name of *Vasa Vasorum*. But Anatomists seem hitherto to have forgotten to mention lymphatics among the *vasa vasorum*, which Mr. Cruikshank has seen covering the *aorta* almost throughout its whole length, filled with mercury (p. 62.). The trunks of the absorbents often make grooves in the coats of arteries.

The *Nerves of Arteries* either encircle them by a kind of net-work, or make semicircular turns round them. Hence, blushing and its contrary may be explained.

The *Nerves of Veins* are fewer than of the arteries, the veins being more passive.

The *Pulmonary Artery*, which begins at the anterior, or right ventricle of the heart;—
or from

The *Aorta*, which arises from the posterior, or left ventricle of the heart.

The *Termination* of all the arteries is

1. In the beginning of the veins ⁽²⁸⁹⁾; or
2. On the external surface of the body ⁽²⁹⁰⁾; or
3. In cavities, where they exhale a very subtle fluid.
4. In excretory vessels, which separate from the blood a fluid, noxious to the body, v. g. the matter of perspiration.
5. In particular ducts, or *sinuses*, into which blood is sometimes poured, v. g. the Fallopian tubes, *Penis*, &c.
6. In secretory organs, v. g. the Liver, Testicles, &c.
7. In glands, where they deposite a part of the blood.

⁽²⁸⁹⁾ Perhaps no artery terminates by a blind extremity. The change of arteries into veins, without any intermediate *parenchyma* was almost entirely unknown to the ancients. They imagined, indeed, that blood effused into cavities, and coagulated, formed the greater part of all the *viscera*; they called the spleen and the liver *parenchymata*. For *parenchyma* properly signified, among them, blood extravasated and coagulated. In general, every artery has its corresponding vein, and the vein is reflected backwards, and passes from the end of the artery towards the right side of the heart.

⁽²⁹⁰⁾ The arteries that terminate on the surface of the body, pour out the sweat, and the matter of perspiration. The excretory vessels (4.) are probably only the ends of the arteries.

The *Use of the arteries* is to convey blood from the heart to every part of the body; to separate a liquor from the blood necessary to nutrition and life, and to exterminate whatever is useless, or hurtful.

The *structure of the Veins* is the same as that of the arteries, excepting that the veins have no muscular coat.

The veins differ from the arteries.

1. Veins are generally thinner, and weaker, than arteries.
2. Their diameter is greater than that of the arteries with which they are connected; there is, however, an exception to this, the diameter of the pulmonary arteries being equal and similar to that of the pulmonary veins ⁽²⁹¹⁾.
3. The number of veins is greater than that of arteries ⁽²⁹²⁾.

4. Veins

⁽²⁹¹⁾ Consult Monro in the Medical Essays and Obs. Vol. II. and Cruikshank's Anatomy of the Absorbing Vessels. Ed. II. p. 60. It was necessary that the arteries should be less than the veins, because the velocity of the blood is so much greater in the arteries than in the veins; it is supposed by Dr. Hales to be nearly as 16 to 1.

But in a *foetus*, the orifice of the pulmonary artery is somewhat larger than that of the *aorta*; for the lungs of a *foetus* being collapsed, the pulmonary artery cannot propel all its blood through the lungs, but sends it through the *ductus arteriosus* into the *aorta*. So that the pulmonary artery is more distended in a *foetus*. For other reasons of the equal size of the orifices of the *aorta* and pulmonary artery consult the notes upon the difference between the embryo and the adult.

⁽²⁹²⁾ The number of the veins, as well as their capacity, is greater than of the arteries. But there are exceptions to this; in the umbilical cord there are two
arteries

4. Veins do not vibrate.

5. Their seat is more superficial than that of the arteries ⁽²⁹³⁾.

6. The veins have more valves than the arteries ⁽²⁹⁴⁾.

A *Valve* is a semilunar fold, easily moved, and continued from the two internal coats of the vessel. Its concave surface is towards the heart, and its convex surface towards the parts distant from the heart. The valves are connected by a semilunar margin to the interior side of the vessels, from which they arise; the external margin of the valves moves freely in the cavity of the vessels. There is oftener only one valve, sometimes two, or three on the sides of a vessel.

arteries to one vein; as there are also in the *penis*, *clitoris*, gall-bladder, &c. but in these examples, the great size of the veins compensates for their small number.

⁽²⁹³⁾ The cutaneous veins are turgid in summer, but almost wholly contracted in winter. The Arteries and Veins generally accompany each other, but not every where, in the body. They do not accompany each other in the brain. The capillary branches of both kinds generally accompany each other.

The veins forsake the arteries many times; thus the cephalic, basilic, *venae saphaenae*, and the external jugular vein, pass along under the skin, accompanied by no arteries, or by very small branches.

In general the trunks of the veins lie immediately under the skin, and send off branches inwards; but the arteries, on the contrary, lie deep and safe from injuries, and send off branches outwards.

⁽²⁹⁴⁾ The arteries have no valves, except the *aorta* and pulmonary artery at their beginning.

Haller believed the veins to have fewer windings than the arteries (*Elem. Phys.*).

The *Use* of the valves is to prevent the blood from being moved towards the apex, or narrower part of the veins.

All the veins have not valves, as will be particularly noticed in the proper place.

The veins arise,

1. From the whole surface of the body (²⁹⁵).
2. From

(²⁹⁵) Red veins do not arise from the surface of the body by open mouths, nor from the internal cavities mentioned by Leber, 2. Consequently they do not absorb from the surface of the body, nor from the surface of internal cavities. It was imagined by Meckel, Haller, Kaaw, Boerhaave, Leiberkun, and others, that veins do absorb: but Mr. John Hunter has proved that they do not (Medical Comment. by Dr. W. Hunter.).

“ I know there are lymphatics in the mother’s part (of the *placenta*); but there the veins also arise by open mouths, out of cells, and the blood contained in these cells enters these mouths, and mingles with the circulating blood. This, according to some, is clearly venous absorption; the structure of the corpora cavernosa, penis and clitoris, seems a good deal to resemble that of the mother’s part of the placenta, and the veins appear to arise from cells there too. That the blood gets into these veins, from those cells, I do not doubt; but I used to explain this as circulation of the blood, not absorption, in the way Hervey conceived it to be, in the other parts of the body, nearly; that is, he conceived the blood to be thrown from the arteries into a parenchyma, or spongy texture, interposed between the ends of the arteries and beginnings of veins; and that the vis a tergo, in the arterial blood, propelled it not only through the sponge, but into the veins. Doctor Fordyce says, there must be something else in the structure of these parts, not yet understood, and rejects not only the solution I have given, of the passage of blood into veins, but denies the possibility of venous absorption any where, on the principles of hydrostatics, independent of the other arguments I have given. Supposing, says he, an opening made in a vein, there is a pressure equal to the force
of

2. From the surface of internal cavities.
3. From the ends of the arteries.
4. From particular cavities, e. g. the *corpora cavernosa* of the *penis*, *urethra*, *vagina*, &c.

5. From lymphatic glands :

The veins end,

1. In the *Vena Cava*,
2. In the Pulmonary Veins,
3. In the *Vena Portae*, but lastly in the *sinuses* and auricles of the heart.

The *Office* of the veins is to return the blood from every part of the body to the heart; to absorb the fluids exuded on the external and internal surface of the body, and to carry them also to the heart.

of the circulation in the veins, to force the blood out at this opening; it would therefore flow out, and remain out, unless there was a force superior to this pressure to throw it in again; but we know of no such force existing in the veins of the common structure. Nor is it possible that the *vis a tergo*, alledged by Hervey, can produce the supposed effects; for the cells of the supposed parenchyma, of the placenta, and *corpora cavernosa*, mentioned, are not tense at the time of the venous absorption, as it has been called. We know of no force in cavities capable of overcoming the pressure of the venous blood on the sides of the vessels, and of propelling fluids into their supposed open extremities, though we can easily conceive the muscular force of the lymphatics overcoming this pressure, in the angles between the jugulars and subclavians, for reasons which will be mentioned afterwards." Cruikshank's *Anatomy of the Absorbing Vessels*, p. 28.

Of the Arterial System in general.

The *Aorta* is scarcely arisen from the heart, before it sends off the *coronary arteries*; it then passes to the left side of the spine, forming its *curvature*, and as it descends by the side of the spine, it acquires the name of *aorta descendens*.

From the convex part of the curvature, or arc, of the *aorta* there arise three vessels, viz.

1. *Arteria innominata*, which divides into
 - a. The *Right Carotid*, and
 - b. The *Right Subclavian*.
2. The *Left Carotid*.
3. The *Left Subclavian*.

Each CAROTID ARTERY is divided into *external* and *internal*: the *external* gives off four branches:

Anteriorly,

1. The *superior thyroideal*, or guttural,
2. The *sublingual*, or ranine,
3. The *inferior maxillary*,
4. The *external maxillary*; from which arise,
 - a. The *mental*,
 - b. The *coronary* of the lips (²⁹⁶),
 - c. The *angular*.

Posteriorly,

5. The *ascending pharyngeal*,
6. The *occipital*,
7. The *external auditory*, and

(²⁹⁶) The *coronary arteries* of the lip send off many ramifications without decreasing in size. The reason of which is very easily assignable, from considering the junction of the left and right trunks (Haller, *Elem. Phys.* Tom. I.).

8. The *temporal*; of which

- a. The *Frontal* is a branch.

On the internal side of the lower jaw, near the articular condyle, the external carotid is called *internal maxillary*; its branches are

1. The *sphaeno maxillary*; from which arise

- a. The *anterior of the dura mater*,
- b. The *superior alveolar*, and
- c. *Superior maxillary*.

2. The *inferior alveolar*,3. The *middle artery of the dura mater*, or *spheno-spinosa*.

The INTERNAL CAROTID, or *cerebral* gives off within the *cranium*

1. The *ophthalmic*, or *internal orbital*: whence arises

- a. The *ciliary*, and in general
- b. The *central artery of the retina*.

The *internal carotid* being then divided into two principal branches, of which the one is called

- a. *Anterior cerebral*, the other
- b. *Posterior cerebral*.

The SUBCLAVIAN ARTERY is divided into the four following principal branches:

1. *Internal mammary*, from whence comes

- a. The *mediastinal*,
- b. The *thymal*, and
- c. The *pericardiac*: from this last also is derived,
 - a. The *superior diaphragmatic* and
 - β. The *tracheal*, or *inferior guttural*.

2. *Cervical*, which is either

- a. *Anterior cervical*, or

b. *Poste-*

b. *Posterior cervical.*

3. *Vertebral*, which uniting within the *cranium* form the *Basilar* artery.

From these branches there arise also

- a. The *internal auditory*,
- b. The *posterior* of the *dura mater*,
- c. The *anterior spinal*,
- d. The *posterior spinal*,

4. *Superior intercostal.*

As soon as the trunk of the subclavian is gotten to the *axilla*, it is called *axillary artery*; and in the arm *brachial*. The following are five branches of the axillary artery: viz.

1. The *external mamillary*,
2. The *inferior thoracic*,
3. The *external scapular*,
4. The *internal scapular*,
5. The *humeral*.

The *brachial artery*, after affording many collateral ramifications to the parts near it, is divided in the cubit,—but oftener where the axillary artery ends,—into two branches:

1. The *Cubital*,
2. The *Radial*.

The *Cubital Artery* sends off five branches:

- a. *Cubital recurrent*,
- b. *External interosseal*,
- c. *Internal interosseal*,
- d. *Palmar arch*,
- e. *Digital*.

The *Radial Artery* gives off the *Radial Recurrent*; and having passed to the palm of the hand, it gives two *digital* branches, which

which, with many others, communicate with the branches of the cubital artery.

Three branches arise in the thorax from the trunk of the descending aorta :

1. The *Bronchial*,
2. The *Oesophageal*,
3. The *Inferior intercostals*.

There are eight branches from the aorta within the abdomen :

1. The *Coeliac* ; from whence are
 - a. Two *Diaphragmatic* or *inferior phrenic*,
 - b. The *Coronary* of the Stomach,
 - c. The *Hepatic* : from which likewise is

a a. The *Pyloric*,

b b. The greater, or right *Gastric* ;
and from this comes

α. The *Duodenal*, and

β. The right *Gastro-ëpiploic*.

c c. The *Cystic*, or *Capsular*,

d. The *Splenic*. Hence are

a a. The *Pancreatic*, and

b b. The *less*, or *left Gastric*. From which are

α. The *left Gastro-ëpiploic*, and

β. The *middle Gastro-ëpiploic*.

c c. The *Short arteries*, and

d d. The *Epiploic*.

2. The *Superior mesenteric*, or *mesaraic* ; of which the *superior* or *right Colic artery* is a branch.

3. The *Renal*, or *Emulgent* ; from which come

a. The

- a. The *Supra-renal*, and
- b. The *Adipose*.
- 4. The *Spermatic*.
- 5. The *Inferior mesenteric*: from whence is
 - a. The *Left Colic*, and
 - b. The *Internal Haemorrhoidal*.
- 6. The *Lumbar*.
- 7. The *Sacral*.
- 8. The *Iliac*: which are divided into
 - a. *Internal*, and
 - b. *External*.

The *Internal Iliac* has five branches:

- 1. The *Little Iliac*,
- 2. The *Gluteal*,
- 3. The *Ischiatic*,
- 4. The *Common, or Internal Pudendal*:
from which arise
 - a. The *External Haemorrhoidal*,
 - b. The *External Pudendal*.
- 5. The *Obturator*.

The *External Iliac* has two branches:

- 1. The *Epigastric*, and
- 2. The *Small external Iliac*.

The trunk of the external iliac artery having passed under Poupart's ligament, and gotten to the thigh, is called the *Crural Artery*; and this, in its course through the ham, becomes the *Popliteal Artery*.

The *crural artery*, passing through the thigh, gives many branches to the muscles.

The *Popliteal artery* is divided into two: of which one is called

- 1. The *Anterior Tibial Artery*, another
- 2. The *Posterior Tibial Artery*.

From

From the latter of these arteries, is

- a. The *Internal Tibial*,
- b. The *Peroneal* or *Fibular*,
- c. The *Internal* and *External Plantar*,
- d. The *Plantal Arch*; which gives rise to the *Digital Arteries*.

Of the Pulmonary Artery and Veins, in general.

The *Pulmonary Artery* arises from the heart, and is divided into two branches: the one is called

The *right pulmonary artery*, the other
The *left pulmonary artery*.

The *Pulmonary Veins* end in the heart by four branches.

Of the Venous System in general.

1. *Four Pulmonary Veins*.
2. *Superior and Inferior Vena cava*.
3. *Vena Portae*.

Of the Vena Cava.

The *Vena Cava* is divided into *superior* and *inferior*.

The Branches of the *Superior Cava* are,

1. The *Right* and *Left Subclavian*: which receive many branches from the
 - a. *Mediastinum*,
 - b. *Pericardium*,
 - c. *Thyroid Gland*,
 - d. *Thymus*: they also receive
 - e. The *Internal Thoracic Vein*,
 - f. The

f. The *Bronchial*, and
g. The *Superior Intercostals*.

2. The *External*, and

3. The *Internal Jugular* veins.

The *External Jugular* (²⁹⁷) vein receives the

1. *Frontal*,

2. *Angular*,

3. *Temporal*,

4. *Auricular*,

5. *Sublingual*, or *Ranine*, and

6. *Occipital*.

The *Internal Jugular* vein receives the blood from the

1. *Lateral Sinuses* of the *dura mater*,

2. *Guttural*, or *Laryngeal* vein,

3. *Internal Maxillary*.

These following are branches of the *Vena Azygos* :

1. The *Vertebral Veins*,

2. The *Inferior Intercostal*,

3. The *Bronchial*,

4. The *Pericardiac*,

5. The *Diaphragmatic*.

The *Subclavian Vein* takes the name of *axillary*, when it is come to the *axilla* :—It receives the

(²⁹⁷) In the arterial system, it is a very general rule of Nature, to preserve a certain proportion between the trunks and their branches: for when a trunk gives off branches, it is found to decrease in size; and when a branch gives off ramifications, it also decreases (See Note 287.). In the venous system, this rule is not so general; the right jugular is twice as large as the *cava superior*, and the left jugular is often twice as large as the left subclavian.

1. *Scapular*,
2. *Superior and Inferior Thoracic*,
3. *Brachial*,
4. *Cephalic*,
5. *Basilic*,
6. *Median*,
7. *Salvatella*,
8. *Cephalic* of the thumb,
9. *Digital*.

The branches of the inferior *cava* are the

1. *Diaphragmatic*,
2. *Hepatic*,
3. *Renal*, from which come the
 - a. *Capsular*,
 - b. *Adipose*,
 - c. *Left Spermatic*, from the *Left Renal*.
4. *Right Spermatic*,
5. *Lumbar*,
6. *Sacral*,
7. *Right and Left Iliac*; each of which receives
 - a. The *Internal*, and
 - b. The *External Iliac*.

Into the *Internal Iliac*, or *Hypogastric*, blood is conveyed by the following veins:

1. The *Obturator*,
2. The *Dorsal* of the Penis,
3. The *External Haemorrhoidal*,
4. The *Internal Pudendal*.

Into the *External Iliac* passes

1. The *Epigastric Vein*.

As the trunk of the external iliac artery, is called *femoral* or *crural*, when arrived at the thigh, so also is the trunk of the external

ternal iliac vein. And this vein continued in the ham is called, like the artery, *Popliteal*.

The *femoral* vein gradually receives

1. The *External Pudendal*,
2. The *Ischiatic*.

The following arise from the *popliteal* vein:

1. *Anterior Tibial*,
2. *Posterior* ———,
3. *Peroneal*,
4. *Sural*,
5. *Cephalic* of the great toe,
6. *Saphena*,
7. *Plantar*,
8. *Digital*.

Of the Vena Portae.

The *Vena Portae* is divided into two branches:

1. The *Ventral branch*,
2. The *Vena Portae Hepatica*.

Into the ventral branch are terminated,

1. The *Mesaraic*,
2. The *Splenic*,
3. The *Internal Haemorrhoidal*.

The *hepatic branch* is distributed to the whole substance of the Liver, in innumerable ramifications.

Of the Branches that arise from the Curvature of the Aorta.

The trunk of the *Aorta*, which arises from the left ventricle of the heart, has at its beginning *three semilunar valves*, by which the return of the blood into the ventricle is prevented.

vented. Having ascended some inches, it is reflected backward from the left side, and forms *an arch*; it then descends, and is called *Descending Aorta* at the fourth *vertebra* of the back.

The *aorta*, thus begun at the left ventricle of the heart, gives off, before it passes the *pericardium*, the *two Coronary Arteries of the heart*:—these commonly arise from the trunk of the *aorta*, above the semilunar valves, seldom below them, that they may be covered by the valves.

The *Right Coronary* arises between the *aorta* and pulmonary artery.

The *Left Coronary* arises between the left auricle and the *Aorta*.—Both these arteries run upon the heart, and communicate with each other. They likewise ramify throughout the substance of the heart; and, at last, end in the coronary veins. Some branches go to the auricles and *pericardium*, and also to the coats of the *aorta* (²⁹⁸).

From

(²⁹⁸) Winslow says that there is sometimes a third coronary artery, which arises from the *aorta* more backwards, and is spent on the posterior or lower side of the heart (*Exp. Anat. Tom. 2. Sect. IV. § 44.*). See the note on the coronary veins (302.).

Boerhaave and others have believed and taught, that the coronary arteries are dilated while the other arteries of the body are contracted (*Inst. Med. § 183.*). But Haller, who made numerous experiments, never saw the coronary arteries arising below the semilunar valves; so that the orifices of the coronary arteries cannot be closed by the semilunar valves while blood is propelled from the left

From the convex part of the curvature of the aorta, come three principal branches.

The *first*, on the right side, is called *arteria innominata*: it is soon divided into two large branches, the inferior of which, going off together with the principal trunk from the right side, arrives at the clavicle, and becomes *the right subclavian artery*; the other branch, which ascends by the larynx to the head, is called *the right carotid artery*.

The *second branch*, which is middlemost, that comes from the curvature of the aorta, is called *the left carotid*.

The *third branch* is situated more on the left side, and constitutes the *left subclavian*, which is always less than the right. The division and beginning of these arteries is different in some subjects, but similar deviations seldom occur.

Both *Carotid Arteries* ascend almost directly on the sides of the *aspera arteria* as far as the superior margin of the thyroid cartilage; connected, by cellular membrane, with the

ventricle into the *aorta*, as Boerhaave believed. And, if the orifices of the coronary arteries were within the reach of the semilunar valves, the valves themselves, driven against the sides of the *aorta*, would direct the blood in the beginning of the *aorta* into the coronary arteries, so that they would be dilated when the *aorta* itself is dilated. Boerhaave had other arguments to support his opinion, derived from the retrograde angle of the coronary arteries coming from the *aorta*, and the paleness of the heart during its systole; but these can now-a-day need no serious confutation.

jugular

jugular veins, and eighth pair of nerves ⁽²⁹⁹⁾. Here each is divided into two principal branches; viz. *External carotid*, which is the anterior, and *Internal carotid*, or *cerebral artery*, which is the posterior.

I.

The *External Carotid Artery* after it has left the thyroid cartilage and ascended as high as the lower jaw, turns backwards to the articulation of the jaw, and is then called the *Internal Maxillary Artery*. In this course it gives off the following branches:

From its internal margin,

1. The *Thyroideal* or *Superior Laryngeal*, which is distributed to the thyroid gland, the muscles of the larynx and *os hyoides*. It also sends some small ramifications to the jugular glands and skin of the neck.

2. The *Sublingual* or *Ranine Artery*, which arises somewhat above the thyroideal, is distributed to the substance, and muscles of the tongue, and likewise to the sublingual glands.

3. The *Inferior Maxillary Artery*. This goes to the parotid and sublingual glands, to the palate and adjoining muscles.

⁽²⁹⁹⁾ It is of particular importance to remember the situation of this trunk, which is sometimes so superficial as easily to be felt and seen. In opening the jugular vein, and in the operation of tracheotomy, this artery is very liable to be wounded. It sometimes passes the length of six or eight inches, without giving off a single branch.

4. The *External Maxillary Artery*. It runs along the external surface of the lower jaw, over the *masseter* muscle, to the sides of the chin, where it is called the *Mental Artery*. This gives a branch, which dividing into two less ones, goes to the angles of the lips. The superior of these branches follows the course of the orbicular muscles on the upper lip, whilst the inferior follows the course of the same muscle on the under lip, even to the middle; where uniting with the corresponding branches of the opposite side, both are called the *Labial* arteries, or *Coronary Arteries* of the lips. The *Mental Artery* has no sooner given off some ramifications to the muscles of the chin, than it ascends to the sides of the nose, where it again affords branches every way: having reached the internal angle of the eye, where it is called *Angular* artery, it proceeds and is lost in the orbicular muscle of the eye-brows and frontal muscle.

5. The *Ascending Pharyngeal*. This arises from the trunk of the external carotid posteriorly, at its bifurcation; it gives branches to the *pharynx* and *fauces*. A branch likewise passes through the *foramen lacerum*, and goes to the *dura mater*.

From the external margin of the external carotid, come

1. The *Occipital Artery*. This sends branches into the *styloid* and *digastric* muscles, and then passes between the *styloid* and

and mastoid apophyses to the *extensor* muscles of the head. One branch of this artery goes through a *foramen* between the styloid and mastoid apophyses, another branch immediately after, through the jugular *foramen*; and a third through the *foramen magnum* of the occipital bone, to the *dura mater*. This artery communicates also with the vertebral and cervical arteries.

2. The *Auricular* or *External Auditory*, which begins near to the occipital artery, goes to the external ear, to the *membrana tympani*, and temples.

The External Carotid Artery having given these branches, ascends by the parotid gland, upon the zygomatic process and temporal muscle. It gives branches to the parotid gland and the face; and then becomes

The *Temporal Artery*; from which is given a branch to the frontal muscle, and eyebrows, called the *Frontal Artery*.

The trunk of the external carotid passing backward to the lower jaw, sends off the *Internal Maxillary* artery. This artery being a continuation of the trunk of the external carotid, and changing its name at the condyloid process of the lower jaw, passes this process; and after sending some branches to the pterygoid muscles, is divided into the three following:

Spheno-maxillary, which passes through a *foramen* in the temporal process of the sphenoid bone to the middle part of the brain.

It disappears in the temples, the top of the head, and the *dura mater*.

The three following are the most remarkable of its branches :

The *first* as it passes through the fissure of the sphenoidal bone is distributed to the anterior surface of the *dura mater* ; and is called the *Anterior* artery of the *dura mater*.

One branch passing through the orbital canal, sends branches into the pituitary sinus, and to the teeth of the upper jaw, under the name of *Superior alveolar* arteries.

Another goes to the face and eye-brows, and is called by some Anatomists the *Superior maxillary*.

The *second branch* of the internal maxillary artery passes through a canal in the lower jaw, and gives branches to the teeth and their sockets, called *inferior alveolar*. It passes out anteriorly through the *foramen* in the fore-part of the same canal, and communicates with the external maxillary artery, at this place.

The *third branch* of the internal maxillary artery goes through the spinous *foramen* of the sphenoid bone, and is distributed in the middle part of the *dura mater*, and is therefore called the *Middle artery* of the *dura mater*, or *Spheeno-spinal* artery. A twig is said to run from this branch to the Aqueduct of Fallopius, and another to the *cochlea*.

II.

The *Internal Carotid*, or *Cerebral Artery*, immediately at its origin from the principal trunk, passes backward, and ascends in a serpentine direction, without giving off any branches, as high as the *carotic foramen*; then having passed through the carotic canal, it enters the *cranium*, but always in serpentine foldings, included in the *laminae* of the *dura mater*, and goes into the middle of the *cavernosus sinus* of the *ephippium*, and there gives off.

The *Ophthalmic*, or *Orbital Artery*. This artery after passing forwards and inwards under the optic nerve, enters the orbit, sends branches into the lacrymal gland, and one small branch to the nose; then it gives off the *Ciliary Arteries*, which are distributed through the ciliary ligament, and choroid coat of the eye, and the *Central Artery of the Retina*; this latter arises either from the trunk of the ophthalmic artery itself, or from a branch of the ciliary arteries; it runs under the pulp of the optic nerve, enters the middle of the *tunica retina*, and is distributed like a net over the whole surface of this coat. From this artery come the vessels of the *tunica hyaloidea*, and also the posterior artery of the crystalline lens. The trunk of the internal carotid then passes in a curved line through the cavernous *sinus*, and ascends on the sides of the *ephippium*

pium to its superior processes; it perforates the *dura mater*, is reflected backwards, and goes off in two principal branches, known by the name of the *anterior* and *posterior cerebral arteries*.

The *Anterior Cerebral Artery* is united with its fellow coming from the opposite side; it passes upwards and backwards by the *columnae cerebri*, and sends branches to the middle and posterior part of the brain, and also to its third ventricle, its *fornix*, and the *thalami nervorum optictorum*.

The *Posterior Cerebral Artery* passes through the *fissura Sylvii* to the sides of the brain; it affords branches to the *plenus venosus*, and is joined by a large branch to a branch of the vertebral arteries.

It is proper to remark, in this place, that the fabric not only of the tunics of the branches of the internal carotid, but also of the trunk itself is changed, at their entrance into the *cranium*, their coats being thinner and weaker than the coats of any other arteries in the whole body.

There are *Two Subclavian Arteries*, a *right* and *left*; the former arises from the *arteria innominata*, and the latter from the curvature of the *aorta*. They pass behind the clavicle, and under it to the superior margin of the first rib, where they terminate.

From each subclavian there arise the four following branches, viz.

I. The

I.

The *Internal Mammary Artery*: it arises from the anterior and inferior part of the subclavian, at the middle of the clavicle, it descends internally, along the ribs, to the *sternum*, and it gives off the four following branches, viz.

1. The *Mediastinal Artery*, which is distributed to the *mediastinum*.

2. The *Thymal Artery*, which goes to the *thymus*.

3. The *Pericardiac Artery*, which goes to the *pericardium*, and afterwards to the diaphragm, from whence it is called, in that place, the *Superior Diaphragmatic Artery*.

4. The *Tracheal*, or *Inferior Guttural Artery*, which ascends in a winding course, along the *aspera arteria* to the thyroid gland and larynx; is often united to the laryngeal artery, and, for the most part, sends off small branches to the superior part of the *scapula*.

Sometimes all these arteries arise, on the right side, from the very trunk of the right subclavian.

The *Internal Mammary Artery* sends branches also to the *mammæ* and intercostal muscles, that are united with the external mammary artery. It then descends by the side of the xiphoid cartilage, goes out of the *thorax*, and ends in the *rectus abdominalis*

nalis muscle, where it joins the epigastric artery (³⁰⁰). Some of its branches also come into the other abdominal muscles, and into the *peritonaeum*.

II.

The *Cervical*, or *Muscular Artery of the Neck*; it arises superiorly from the trunk of the subclavian artery, and is generally divided, at its origin, into an *anterior* and a *posterior* branch.

The *Anterior Branch*, or *Anterior Cervical Artery*, runs behind the carotid artery, and is chiefly distributed to the muscles that ascend

(³⁰⁰) Boerhaave assigned the sympathy between the *mammæ* and the *uterus* to this union of the mammary and epigastric arteries (*Instit. Med.* § 666.): but physiologists have not been inclined to entertain the same opinion, for various reasons. 1mo. The epigastric artery, which comes from the internal iliac, is no more connected with the arteries of the *uterus*, than the subclavian artery is with the trunk of the *aorta*. 2do. There is a consent between other parts of the body, where there is no remarkable communication by arteries and veins. And, the communication of the mammary and epigastric arteries and veins is very small. 3tio. It is unreasonable to imagine that the blood of the epigastric artery should pass into the mammary arteries; or, that the blood of the mammary arteries should pass into the epigastric; for in the former case, the small quantity of blood must overcome the resistance of the blood contained in the mammary arteries, and moving in an opposite course; and in the latter, the blood of the mammary arteries must overcome the resistance of that in the epigastric, moving in a contrary direction.

from the *sternum* into the neck, and likewise to some muscles of the neck, to the muscles of the *pharynx*, and to the glands of the *larynx*.

Sometimes from this artery the Superior Intercostal arises.

The *Posterior Branch*, or *Posterior Cervical Artery* arises sometimes also from the vertebral artery; it passes under the transverse process of the seventh *vertebra* of the neck to some muscles of the neck and *scapula*, in which it disappears. A branch of this is often joined to the occipital artery,

III,

The *Vertebral Arteries*, both of them, arise from the subclavian; but sometimes the left, though seldom, arises from the arch of the *aorta*. Before they give off any branch, they pass to the cervical *vertebrae*, and ascend from thence through the *foramina* of their transverse processes, in such a manner that they first enter the *foramen* of the sixth *vertebra*, and afterwards pass through the fifth, fourth, and third, in a serpentine direction. In this course, they give off branches to the muscles of the neck, and the *involucra* of the spinal marrow. They proceed from thence through the *foramen* of the second *vertebra* of the neck, obliquely upwards and outwards; pass forwards and outwards between the transverse processes of the first and second *vertebrae*
of

of the neck; make a large curvature posteriorly, and go through the *foramen* of the first cervical *vertebra*: in this place, they surround a furrow, in the transverse process, of the *vertebra* last mentioned, and then perforate the *dura mater*, and enter the *cranium* through the *foramen magnum occipitale*; they ascend with the *medulla oblongata*, and unite there, at a very acute angle, into one common trunk, called the *Basilar Artery*. This Artery, which some call the *Cervical*, afterwards perforates the *dura mater*, under the *pons Varolii*, and sends branches that unite, here and there, with the branches of the carotids, into the *medulla oblongata*, *cerebrum*, and *cerebellum*. Other branches of this artery, that deserve to be noticed, are

1. The *Internal Auditory Artery*, which passes with the seventh pair of nerves to the internal parts of the ear:

2. The *Posterior Artery of the Dura Mater*, which is dispersed through the posterior part of the *dura mater*.

3. The *Anterior and Posterior Spinal Arteries*: these arise not from the basilar artery, but from the vertebral arteries. For each of the vertebral arteries gives off a branch, at its entrance into the *cranium*: these branches immediately come together into one common trunk, which descends posteriorly in the course of the *medulla spinalis*, and is called the *posterior spinal artery*. A little higher than this, each of the vertebral arteries sends off a similar

milar branch, which also unites with its fellow, and forms one common trunk, that descends anteriorly with the spinal marrow, and is of consequence called the *anterior spinal artery*. Both spinal arteries are united, in the spinal marrow, with some branches of the intercostal artery.

It remains now to be observed of the fabric of the vertebral arteries, as it was before [observed of the carotids, that their coats become more delicate, at their ingress into the *cranium*.

IV.

The *Superior Intercostal Artery* arises from the subclavian, but sometimes also from the trunk of the cervical arteries. It runs on the internal surface of the three, or four, superior, true ribs, near their heads; it gives a branch to each rib, which passes forwards at the inferior margin, and it immerses as well into the intercostal muscles as the *pleura*. Small branches go through the lateral *foramina* to the spinal marrow.

When the trunk of the subclavian artery passes, above the first rib, over the *scaleni* muscles of the neck, from the cavity of the *thorax*, it is called the *Axillary Artery*. From the axillary artery there arise the following branches, viz.

1. The *Thoracic*, or *External Mammary Artery*, which gives branches to the *mammæ*,
and

and muscles placed on the breast. One branch runs downwards, between the *pectoralis major* muscle and the deltoid near the *vena cephalica* of the arm, in the direction of the *humerus*.

2. The *Inferior Thoracic Artery*, which is distributed to the muscles of the *scapula* and back.

3. The *External and Internal Scapular Artery*: the *external* lies in the hollow of the superior margin of the *scapula*; it is distributed through the muscles of the *scapula*, and about the articulation of the *humerus*: the *internal* sends branches not only into the muscles, but also into the glands of the arm-pit.

4. The *Humeral Artery*: it arises sometimes from the brachial artery; it is distributed to the muscles of the *scapula* and *humerus*.

Having given off these branches, the axillary artery emerges under the tendon of the *pectoralis major* muscle, and is then called the *Brachial Artery*.

The *Brachial Artery* is sometimes divided into two, at its origin, but it generally descends in only one trunk, on the inside of the arm, above the coracoid muscle of the *humerus*, and the *anconaeus* muscle, at the inner margin of the *biceps* muscle, behind the *vena basilica*, to the condyles of the *os humeri*. From the arm-pit to the middle of the *os humeri*, it is covered only by the common integuments; but

but it afterwards immerses deep into the muscles, and, in this course, it encreases the number of arteries in the neighbouring muscles, and in the *os humeri* itself. It is divided generally into two large branches, between the inferior condyles of the *os humeri*, after having given off numerous branches to the contiguous muscles, and to the articulation of the *humerus*, under the name of *Collateral Arteries*. One branch of the brachial artery is called *Cubital*, the other is called *Radial*.

The *Cubital*, or *Ulnar Artery* passes between the *pronator rotundus*, the *radialis internus*, the *palmaris longus*, and the *flexor* muscles of the fingers, and the *ulna*, in the direction of the *cubitaes internus* muscle, as far as the wrist, in which course, it gives off the following branches, viz.

1. The *Cubital Recurrent Artery*, which runs backwards to the internal condyle of the *humerus*; it is distributed to the articulation, and it communicates with the lateral branches of the brachial artery.

2. Some small branches that are immersed in the contiguous muscles.

3. The *External Inter-osseal Artery*, which arises about three fingers breadth under the articulation, perforates the inter-osseal ligament, immediately at its beginning, runs in the direction of this ligament, and on its external surface to the anterior extremity of the fore-arm, where it unites to a branch of the internal inter-osseal artery. But at last it
is

is lost in the external inter-osseal muscles of the hand. There go likewise from this two large branches to the muscles of the forearm.

4. The *Internal Inter-osseal Artery*: it arises immediately under the former, and goes along the inside of the inter-osseal ligament downwards to the *pronator quadratus* muscle; at which place, it perforates the ligament, and after being united to branches of the external inter-osseal, and radial artery, it is distributed on the outside of the wrist and back of the hand. Besides, it gives off a particular branch, that perforates the internal ligament of the wrist, and is expanded on the inside of the wrist.

The Cubital Artery, after giving off these branches, mounts the internal ligament of the *carpus*, and enters the palm of the hand on the side of the *os pisiforme*. In this course, it gives off branches to contiguous muscles, and to the skin; of which branches one passes between the third and fourth metacarpal bone, and is joined, on the back of the hand, with the external inter-osseal artery. From the *os pisiforme* towards the thumb, the cubital artery makes a curve, which is called the *Palmar Arch*.

The *Palmar Arch* has arising from its convex side three or four arteries, which run to the anterior extremities of the metacarpal bones; at this place, each of them is divided into two branches, which run on the sides
of

of the fingers, even to their tips; but in order, from the side of the little finger to the outside of the fore finger, where they are joined, and take the name of *Digital Arteries*.

From the concave side of the palmar arch, there arises one branch, which is united, at the thumb, with a branch of the radial artery. There arise also from hence two digital arteries, not yet mentioned, which pass along the inside of the fore finger, and the opposite side of the thumb.

The *Radiaeal*, or *Radial Artery* arises sometimes, though rarely, from the cubital artery, above the bend of the cubit; it then gives off the *Radiaeal Recurrent Artery*, which returns to the bend of the cubit, where it joins with lateral branches of the brachial artery, and disappears in the neighbouring muscles. The *Radiaeal Artery* then descends between the *supinator longus* muscle and the *radius* even to its extremity, and gives off, in this course, numerous branches to the contiguous muscles. When it goes inferiorly along the wrist, it lies under the skin, and immediately on the bone, so that the pulsations which it makes may be easily perceived by the finger. It is at this place that we feel the pulse. It sometimes enters superiorly into the palm of the hand, between the fore-finger and the thumb; but it is sometimes turned rather backwards, and then the pulse cannot be felt at the wrist. But the course of this artery is scarcely

ever alike in both arms. It generally enters the palm of the hand, by the inside of the thumb, and it gives numerous branches to the neighbouring parts; the chief of which communicates with a branch of the palmar arch, and constitutes the two *Digital Arteries*, of which one runs on the inside of the fore-finger, the other on the opposite side of the thumb, to the tip of each; at which place they are joined to the digital artery coming from the opposite side.

The Branches of the Aorta Descendens.

The *Aorta Descendens* begins from the end of the curvature of the *aorta*, near the fourth *vertebra* of the *thorax*; from hence it descends, on the left side of the other *vertebrae*, to the last *vertebra* of the loins; where it is divided into two branches, which are called the *Iliac Arteries*. In this course, before the *aorta* comes to the diaphragm, it gives off the four following branches, viz.

1. The *Bronchial Arteries*: these are distributed through the vesicles of the lungs, and the branches of the *aspera arteria*. They are destined to nourish the lungs. They arise sometimes, by a single branch, from the *aorta*, which is afterwards divided into two; but they sometimes arise from the superior intercostal artery.

2. The *Oesophagaeal Arteries* are generally two or three, but sometimes there is only one.

They

They are distributed through the *oesophagus* and its glands.

3. The *Inferior Intercoastal Arteries*: eight of these arise, on each side, from the *aorta*, and run internally along the inferior margin of each rib, to its middle; each of them then divides into an external and an internal branch; the external going to the *thorax* and external intercoastal muscles, and the internal going to the *pleura* and internal intercoastal muscles. At their origin, posteriorly, each of them sends branches into the coats of the *medulla spinalis* and muscles of the back. From the inferior, some branches go into the diaphragm.

All the intercoastal arteries that run on the right side, immediately at their origin, pass transversely under the *vena azygos*.

4. The *Inferior Diaphragmatic, or Phrenic Arteries*: these are divided into the right and left. The *Right* arises sometimes from the coeliac artery. They are both distributed by numerous branches over the inferior surface of the diaphragm.

In the *Abdomen*, the trunk of the descending *aorta* gives off the eight following branches, viz.

I. The *Coeliac Artery*: this, as was observed, affords the right inferior diaphragmatic artery, and then passes into the three following large branches, viz.

a. The *Coronary Artery of the Stomach*, which surrounds the left orifice of the stomach,

mach, like a crown, and sends its branches into the superior and inferior surface of the right side of the stomach. One branch goes from it into the liver.

b. The *Hepatic Artery*, which is the largest branch of the coeliac artery, arising from its right side, and immediately giving off the three following branches, viz.

α. The *Pyloric Artery*, which is dispersed through the *pylorus*, and joined to the coronary artery of the stomach.

β. The *Right, or Large Gastric Artery*, which sends a branch, at its origin, into the *duodenum*, called the *Duodenal Artery*, and then goes along the right side of the stomach, in the direction of its large arch, and gives branches to the *omentum*, which are called the *Right Gastro-epiploic Arteries*. This Artery is frequently joined to the other arteries of the stomach. The trunk of the hepatic artery passes near the *vena portae* to the fissure of the liver, and there sends out the *Cystic Arteries*.

γ. The *Cystic Arteries* being sent out, the hepatic artery is lastly distributed, together with the branches of the *vena portae*, by innumerable ramifications through the whole substance of the liver.

c. The *Splenic Artery* is the third branch of the coeliac. It comes, on the left side, from the coeliac artery, under the stomach and *pancreas*, and goes to the spleen, and is distributed through its substance, by four

or

or five branches. In its course it gives off the following, viz.

α. The *Pancreatic Artery*, which is distributed through the *pancreas*.

β. The *Left*, or *Small Gastric Artery*, which is dispersed on the left side of the stomach, in the direction of its larger arch; sends into the *omentum* the *Left Gastro-epiploic Arteries*, and is lastly united to the right gastric artery, from which union the *Middle Gastro-epiploic arteries* arise.

γ. The *Short Arteries*, which are distributed through the left extremity of the stomach.

δ. The *Omental*, or *Epiploic Artery*, which also runs to the *omentum*.

II. The *Superior Mesenteric Artery* is another branch of the *aorta* descending in the *abdomen*; it runs between the *laminae* of the mesentery, and gives off numerous branches to the *jejunum*, *ileon*, and *coecum*. It sends a particular branch to *colon*, called the *Right* or *Superior Colic Artery*.

III. The *Renal*, or *Emulgent Arteries* come laterally from the *aorta*. They are two, of which one goes transversely to the right kidney, and the other to the left. But before they are inserted into the concave margin of the kidneys, they give off the *Supra-renal* and *Adipose Arteries of the kidneys*.

We must observe, concerning these arteries, that the right renal artery is longer than the left, because the *Aorta* descends on the left side of the

spine. The renal arteries also run under the *vena cava*.

IV. The *Spermatic Arteries*. One arises, on each side, above, but generally below the renal arteries, from the *aorta*. Sometimes the left spermatic artery comes from the renal artery; and each of them descends outwards, on its own side, before the *psoas* muscle, giving branches, in its course, to the neighbouring parts. A considerable branch goes into the fat of the kidneys. All the branches descend, in a serpentine direction, behind the *peritonaeum*, to the abdominal ring; at which place, they are both joined with the spermatic vein of the same side, the spermatic duct, and a quantity of cellular membrane, so as to form the *Spermatic Cord*, as it is called. Each of them goes to the testicles, through the groin, and having perforated the *tunica albuginea*, is distributed throughout the substance of the testicle, in serpentine convolutions ⁽³⁰¹⁾. In women, these arteries enter the *ovaria* and Fallopian Tubes.

V. The *Inferior Mesenteric Artery*, immediately at its origin, goes off into two branches, but sometimes into more.

a. The first branch goes to the left side of the *colon*, under the name of the *left* or *inferior colic Artery*; and is distributed through

⁽³⁰¹⁾ This artery is described in the description of the testicles.

the *Colon*, and united the right colic Artery.

b. The second branch, or the *Internal Haemorrhoidal* is distributed through the *intestinum rectum*.

VI. The *Lumbar Arteries* arise, five or six on each side; the superior go to the diaphragm and lowermost intercostal muscles, and the inferior are distributed through the lumbar and abdominal muscles. Where they perforate the abdominal muscles, they are called *External Hypogastric Arteries*. Some branches likewise run to the spinal marrow and its coats.

VII. The *Sacral Arteries*: they arise sometimes by a simple trunk, and sometimes by a double, triple, or quadruple trunk, from the *aorta*. They are distributed in the direction of the *os sacrum*, and send some branches inwards to the *cauda equina*.

VIII. The trunk of the *aorta* is lastly divided, at the lowermost *vertebra* of the back, into two large branches, called the *Iliac Arteries*.

The Iliac Arteries, and their Branches.

The *Iliac Arteries*, about two or three fingers breadth from their origin, are divided into two, viz. the *Internal* and the *External Iliac Artery*.

The *Internal Iliac*, or *Hypogastric Artery* is turned forwards from behind, and forms the following branches, viz.

1. In a *foetus*, the *Umbilical Arteries*, which ascend above the *peritoneum*, from the sides of the urinary bladder, perforate the *umbilicus*, and then pass to the *placenta*, to carry blood from the *foetus* into the *uterus*. In adults, these arteries become ligaments.

2. The *Little Iliac*, or *Small Internal Artery*, which arises from the posterior side of the internal iliac artery, and sends branches into the *os sacrum*, the *psoas magnus*, *iliacus internus* muscles, and also to the *ossa ilii*.

3. The *Gluteal Artery*, which is larger than the former, goes out of the *pelvis*, with the ischiatic nerves, through the ischiatic notch; passes, in its course, into the muscles of the *anus*, the *rectum*, and the urinary bladder, and is lastly distributed to the gluteal muscles.

4. The *Ischiatic Artery*: this sends branches to the *os sacrum* and *os ischii*; it goes out at the same notch as the former, and it is distributed among the *glutei* muscles, the articulation of the *femur*, and the *periosteum* of the *os ischii*.

The *Common Pudendal Artery*, immediately at its origin, passes into two branches:

The *Anterior* passes between the urinary bladder and the *rectum*, under the *symphysis* of the pubis: *in men*, it runs along the back of the *penis*, and is inserted into the *corpora spongiosa*, under the name of the *External Pudendal Artery*. In the hollow of the *pelvis*, it gives branches to the *vesiculae seminales*, the neck of the urinary bladder, and the prostate

prostate gland: *in women*, it is distributed through the sides of the *uterus*, where it communicates with the spermatic and hypogastric arteries, from which latter it often arises.

The *Posterior Branch* of the common pudendal artery passes out of the *pelvis*, through the ischiatic notch, and is distributed through the *sphincter ani* under the name of *External Haemorrhoidal Artery*. Some branches pass into the *corpora spongiosa penis* and *urethrae*.

The *Obturator Artery* passes with the small crural nerve through the *foramen ovale*, and is distributed among the *obturator*, and other adjacent muscles. It sends some branches into the inguinal glands and the skin.

The *External Iliac Artery* passes to Poupart's ligament, and there gives off two branches, the inner of which is called the *Epigastric Artery*: this passes somewhat obliquely under the *transversus abdominis* and *rectus* muscles, and above them superiorly, giving branches to them, and joining superiorly with the internal mammary artery.

The *External* branch is called the *Small External Iliac Artery*; it is distributed among the *ossa ilei* and the *obliqui abdominis* muscles.

The trunk of the *External Iliac Artery* afterwards goes out of the *pelvis*, under Poupart's ligament, under the name of the *Crural*, or *Femoral Artery*; it is covered, on the fore and inner part of the thigh, only by skin, but inferiorly by muscles; and it descends to
the

the ham, through the *triceps femoris* muscle, where it is called the *Popliteal Artery*.

In this course, it gives off various branches, of which

The two or three first go under the skin of the *regio pubis* and inguinal glands: then more come from these, which are distributed through all the muscles of the thigh. Lastly, lateral branches go off to unite to the recurrent arteries of the *tibia*. It must be observed, in this place, that the femoral artery, immediately under Poupart's ligament, is sometimes divided into two branches, the smaller of which ascends on the outside of the thigh, between the *rectus* and *cruraeus* muscles, and the larger passes on the inside as far as the ham, and constitutes the *Popliteal Artery*.

The *Popliteal Artery* sends some branches into the ham and the adjacent muscles. It is bifurcated about two fingers breadth below the ham, into the *Anterior* and *Posterior Tibial Artery*.

The *Anterior Tibial Artery* superiorly perforates the interosseal ligament, ascends upon it, and descends forwards to the back of the bottom of the foot; giving off branches, in this course, that unite with the lateral branches of the popliteal artery, and others that unite with the posterior tibial artery, and the peroneal, or fibular artery, dispersed every way through the adjacent parts.

When it is gone upon the back of the foot,

near the great-toe, it perforates the muscles situated there between the *ossa metatarsi*: it is then joined in the sole of the foot with the posterior tibial artery, forming by this mechanism the *Plantar Arch*. The other branches are distributed through the muscles of the *metatarsus*.

The *Posterior Tibial Artery* again divides into two branches, the inner of which is called properly the *Posterior Tibial Artery*, or the *Great Fibial Artery*; and the outer the *Peroneal*, or *Fibular Artery*.

The *Great Sural Artery* descends on the inner and posterior side of the *tibia*, and, besides various branches going into the adjacent parts, it sends a branch into the superior part of the *tibia*, which goes into its substance. It then goes behind the internal ankle to the sole of the foot, where likewise it divides into two branches, known by the names of the *External* and *Internal Plantar Arteries*.

The *External Plantar Artery* is united, as already observed, with a branch of the anterior tibial artery, forming the plantar arch. From the convex part of this arch arise the *Digital Arteries* of the feet. From the concave part branches arise that go into the muscles of the sole of the foot.

The *Internal Plantar Artery* divides in the middle of the sole of the foot: one branch being joined with some branches of the anterior tibial artery, and passing to the great toe;

toe; the other being distributed among the phalanxes of the other toes, and there united with branches of the plantar arteries.

The *Peroneal Artery* descends on the posterior side of the *fibula*: it perforates the interosseal ligament at the inferior extremity of the *fibula*; it emerges on the back of the foot, and is distributed in branches upon it. It is also joined posteriorly to the *tibialis antica* and *postica*.

The Pulmonary Arteries and Veins.

The *Pulmonary Artery* arises from the anterior or right ventricle of the heart, as the *aorta* arises from the left. It has three valves, of a semilunar shape, like the *aorta*, but somewhat smaller, and weaker, nor always possessed of tubercles. It passes to the lungs, and immediately divides into two branches; the right of which goes under the arch of the *aorta* to the right lung, and the left to the left lung. Both these branches are distributed by innumerable branches through the substance of the lungs, surrounding the vesicles like a net-work, and ending in the pulmonary veins.

The *Pulmonary Veins* arise by innumerable small beginnings from the ends of the pulmonary artery; most of them uniting commonly into four trunks, which evacuate themselves within the *pericardium*, into the left or posterior *sinus* of the heart. It remains to be
observed

observed that they are less than the arteries ; and that they have no valves.

The Vena Cava.

The *Vena Cava* is divided into *Superior* and *Inferior*, both uniting within the *pericardium*, and being expanded there into a sac possessed of numerous muscular fibres, which is called the right or anterior *sinus* of the heart. Where the *vena cava inferior* ends in the *sinus*, there is a membranous valve, of a semilunar form, separating the *sinus* from the *cava*, called, from its inventor's name, *Valvula Eustachii* ⁽³⁰²⁾.

The

⁽³⁰²⁾ The coronary veins of the heart are not described by many anatomists in their history of the veins, because they are not immediately joined to any other vein (Winflow, *Exp. Anat. Tom. 2. Sect. V. § 17.*). The exterior course of the coronary veins is much the same as that of the arteries ; but they end partly in the right auricle, and partly in the right ventricle. Their trunk opens chiefly into the right auricle by an orifice that is covered with a valve commonly called *Semilunar*, but more truly *Annular*, *Oblong*, and *Narrow*. This valve was known to Galen and Eustachius ; but C. F. Wolf was the first who taught that its figure is not semilunar, but oblong : he says it is thin, pellucid, and perforated with numerous small holes ; that it is a valve *sui generis*, and unlike any other in the body. The situation of the orifice of this large coronary vein is, according to C. F. Wolf, between the two large openings into the right *sinus*, between the opening of the *vena cava inferior*, and the venous opening of the right ventricle, and that part of it in particular to which the valve of the *septum* answers. So that, in the adult, the *Valvula Eustachii* adheres by its anterior extremity

The *Cava Superior* receives all the blood returning from the head, neck, thorax, and superior extremities.

The *Cava Inferior* receives all the blood returning from the *abdomen* and inferior extremities.

The Veins of the Head.

All the blood of the head, face and neck is emptied into the two *Internal* and two *External Jugular Veins*.

The *Internal Jugular Veins* arise from the *foramen lacerum* on each side: they receive all the blood from the brain and *cerebellum*, returned from the two lateral sinuses into the *sinus* of the *dura mater*: they descend in the neck, over the carotid arteries, and receive in this course,

The *Guttural* or *Thyroideal* and the *Internal Maxillary Veins*: they evacuate themselves below these into the subclavian veins.

The *External Jugular Veins* arise from a conflux of the branches

Of the *Frontal*,

to the common opening. The use of this valve is clearly to prevent the return of blood into the coronary vein: and the situation of the proper orifice being contrary to the common orifice, is another mean of preventing the return of the blood: for if blood should happen to pass into the *sacculus*, under the valve through the common orifice, it cannot be impelled with all its force into the coronary vein and its proper orifice; but rather into the bottom of the *sacculus*; where its *impetus* being considerably lessened, it cannot much affect the proper orifice (*Comment. de Reb. &c. Lipsiae, Vol. 29. p. 399.*).

Of

Of the *Angular*,
 ——— *Temporal*,
 ——— *Auricular*,
 ——— *Ranine*, or *Sublingual*, and
 ——— *Occipital vein*: they descend, on each side of the neck, immediately under the integuments; and they return the blood brought back from these parts to the subclavian veins.

The Veins of the Upper Extremities.

The *Digital Veins* empty their blood into

1. The *Cephalic Vein of the Thumb*, which runs on the back of the hand along the thumb, and empties its blood into the external radial vein.

2. The *Vena Salvatella*, which returns along the little finger, is united with the former, and empties its blood into the *Internal and External Cubital Veins*.

1. The *Vena Cephalica Major*,

2. Into the *Vena Basilica*, and

3. Into the *Vena Mediana*.

The *Vena Cephalica Major* is situated on the superior part of the fore-arm; and arises from the union of the *radialis externa* and the *mediana cephalica minor*.

The *Vena basilica* ascends on the under side of the *humerus*, and arises from the conflux of

1. The external and internal cubital veins;

2. The *Venae Satellitum*, which accompany the brachial artery as far as the bend of the cubit, and are distributed on both sides in the adjacent muscles, and 3. The *Vena Superior Profunda*.

The

The *Median Vein* is situated in the middle of the fore-arm, and arises from the union of 1. The *Vena Cephalica Mediana Major*; 2. The *Vena Profunda Inferior*; and 3. The *Internal Radial Vein*: it ascends into the bend of the cubit, and is there joined to the *Vena Cephalica Magna*, and *Vena Basilica*.

All the Veins already mentioned unite into one in the shoulder, called

The *Brachial Vein*: this ascends on the inside of the shoulder as high as the *axilla*, and it changes its name as it enters it, and is called

The *Axillary Vein*: this receives the superior and inferior thoracic vein, the *vena muscularis*, and the internal and external scapular veins. When it comes under the clavicle, it is called the Subclavian Vein.

Into the subclavian veins are emptied

1. The External Jugular Vein,
2. The Internal Jugular Vein,
3. The Vertebral Vein, that receives the cervical and the vertebral sinuses.

4. Before the subclavian veins end in the *vena cava*, the following veins empty themselves into them, *viz.*

- The Mediastinal,
- The Pericardiac,
- The Diaphragmatic, or Phrenic,
- The Thymic,
- The Internal Mammary,
- The Laryngeal, and sometimes
- The Superior Intercostal.

Both subclavians unite, on the right side into one trunk, in the cavity of the thorax.

This

This trunk is called *Vena Cava Superior*, or *Descendens*. After receiving the *Vena Azygos*, it descends, and, as was before observed, empties itself into the right *sinus* of the heart.

The *Vena Azygos* is formed by the following branches; viz.

1. The Bronchial,
2. The *Oesophageae Superiores dextrae*,
3. The *Vertebrales*,
4. The *Intercostales Dextrae Superiores*,
5. ————— et *Sinistrae Inferiores*.

The Veins of the Inferior Extremities.

The *Digital Veins*: these arise on the tips of the toes, and empty themselves into

1. The *Cephalic Vein* of the great toe, which runs along this toe, over the internal angle.
2. The *Vena Saphena*, which ascends along the little toe over the external angle, and into
3. The *Vena Dorsalis Pedis*.

These three veins coming together, form the *Anterior Tibial Vein*, which, being united to the posterior tibial vein inferiorly, ascends forwards, and perforates the inter-osseal ligament.

The *Posterior Tibial Vein* receives inferiorly the plantar veins, and superiorly the sural vein.

The *Peroneal Vein* ascends, in the direction of the *fibula*, behind the external angle. Before it comes to the ham, it unites, with the

former two, into one trunk, which is called the *Subpopliteal Vein*.

The *Subpopliteal Vein* ascends through the ham ; and, as it goes from it, is called

The *Crural, or Femoral Vein*.

The *crural vein* ascends further over the anterior surface of the thigh to Poupart's ligament ; enters the *pelvis* through it, and is there called

The *External Iliac Vein* ; this receives the external pudendal veins returning from the inguinal glands ; and it comes into one trunk with the internal iliac, forming with it the *vena cava inferior, or ascendens*.

The *Vena Cava Inferior* arises from the iliac veins at the last *vertebra* of the loins, it ascends on the right side of the spine, enters the *thorax* through the right *foramen* of the diaphragm, and is united, near the heart, with the *vena cava superior*, forming the anterior *sinus* of the heart.

Besides the iliac veins in the hollow of the *pelvis*, it receives the following branches, *viz.*

1. The Sacral Veins,
2. The Lumbar —,
3. The Right Spermatic —,
4. The Renal —,
5. The Hepatic, in the cavity of the *thorax*.

6. The Diaphragmatic, or Inferior Phrenic.
The *Internal Iliac Vein* receives

1. The External Haemorrhoidal veins, returning from the *anus* ; and

2. The

2. The Hypogastric Veins; into which latter flow

1. The Internal Pudendal Veins,
2. The *Pudenda Dorsalis Penis*, and
3. The *Obturatoria*, returning with other veins, from the adjacent parts.

The Vena Portae, and its Branches.

The *Vena Portae* is that large vein, which returns blood from the intestines, spleen, and stomach, to the liver: it is distributed in numerous branches through the liver, like an artery. The Blood, which it carries, is destined for the formation of bile: the remaining blood is brought by branches into the trunk of the *cava*.

The trunk of the *vena portae* is divided into two branches: the *Superior*, which is dispersed through the liver, is called the *Vena Portae Hepatica*: the *Inferior* is called *Vena Portae Ventralis*.

The *Vena Portae Ventralis* arises from the union of the three following principal branches:

I.

The *Splenic Vein*, which having arisen by an oblique course from the spleen, enters the fissure of the liver, on the right side, and receives in this course, the following branches:

1. The *Coronary vein* of the stomach,

D d 2

2. The

2. The *Pancreatic vein*, and
3. The *Gastric*, or *Left Gastro-epiploic*.

II.

The *Mesenteric Vein*; which receives

1. The *Right* and *Left Colic Vein*, which is united to small branches of the internal *Haemorrhoidal*; and
2. The *Gastro-colic*, into which the *gastro-epiploica dextra* empties itself.

III.

The *Internal Haemorrhoidal Vein*: it arises from branches that return from the *anus*, and *rectum*, and also from the *mesocolon*. It is also enlarged by branches returning from the greater *mesenteric vein*, and from the *Right* and *Left gastro-epiploic vein*.

The three principal branches now mentioned come together into one trunk; which is united to the trunk of the *hepatic vein* distributed through the *liver*: and by the union of these three is formed the *Vena Portae*.

Of the Circulation of the Blood in a foetus.

In a child, as soon as it is born, and in every adult, we know the circulation of the blood to be performed in the following manner.

The Blood, by the contraction of the right ventricle of the heart, is driven into the *pulmonary artery*: and this is again contracted after its expansion: and as the blood cannot re-
turn

turn into the heart, because of the femilunar valves before mentioned, placed at the beginning of the pulmonary artery ; and because of the pulmonary artery being closed by the valves, the blood is propelled into the extreme ends of the pulmonary artery, through the whole lungs. It is then received by the ends of the pulmonary veins, and carried back into the left, or posterior ventricle of the heart. The left ventricle, upon receiving this mass of blood, is immediately contracted, and, contracting like the right ventricle, forces the blood into the *aorta*. The *aorta* itself is then contracted, and drives the blood contained in it into all the *viscera*, and every part of the body, through the extremities of the arteries ; in which parts, according to the different fabric of the part, various liquors are separated from the blood. The blood that remains after the nourishment of parts, and secretion, is received by very small veins, and passes from them into larger, and, lastly, into the *vena cava superior* and *inferior*, which again returns all the blood to the right ventricle, from which it was before expelled. Such is the circulation of the blood in adults, and in children as soon as they are born.

But in a *foetus*, or an *embryo*, the course of the blood is far different: for the *foetus* receives its blood from the mother by means of the umbilical vein, and returns it to the mother through the umbilical arteries contained in the umbilical cord.

The *Umbilical Cord* is composed of the umbilical vein, and two umbilical arteries.

The *Umbilical Vein* arises from the conflux of the veins of the *placenta uterina*, which receive their blood from the ends of the arteries of the *uterus*; and it then goes through the navel with the umbilical cord, ascends over the *peritonaeum* to the liver, and is there emptied into the *sinus* of the *vena portae*. From this *sinus* the *Canalis Venosus*, as it is called, carries the blood to the *vena cava* which ascends behind the liver; by means of which the blood is carried onwards to the heart. This blood is then immediately forced from the right into the left auricle, through the *foramen ovale*: and the remaining blood is carried into the right ventricle, from which it passes into the pulmonary artery, but in very small quantity through the lungs; for the greater part passes into the cavity of the *aorta*, through the *Canalis Arteriosus Botalli*, which arises from the pulmonary artery, and is inserted obliquely into the trunk of the *aorta*.

From the *aorta* the blood passes, as in the adult, into every part of the body; and thus it is propelled into the umbilical arteries before mentioned. The umbilical arteries arise from the internal iliac arteries, ascend near the bladder to the navel, and go through it, with the umbilical cord, to the *placenta*, in which their ends are joined with the very small veins of the *uterus*, and thus their blood is poured into the veins.

T H E
D O C T R I N E
O F T H E
L Y M P H A T I C V E S S E L S.

BY the term *Lymphatic Vessels* is understood small, transparent veins, which return from various parts of the body, a pellucid, colourless liquid, sometimes yellowish or reddish (³⁹³). These lymphatic vessels together

(³⁹³) Lymphatic vessels differ from the veins which terminate in the heart, in many respects. They are not full in the dead body, as veins are; neither do they contain a coloured liquor. They are more irritable than either arteries or veins, and they have more valves than the latter, as is evident from their knotty appearance. Their ramifications are more numerous by far, and more contiguous one to another than those of arteries or veins. They sometimes run two or three feet, without ramifying, which the blood-vessels never do. Their branches also bear a very different proportion to their trunks, from what the branches of the blood-vessels do (See Note 287.): Mr. Cruickshank saw a lymphatic coming out of a gland in the groin, that was larger than any part of the thoracic duct, except its beginning and termination (Anatomy of the absorbing vessels, p. 90.).

with the *Lacteals*, which may be more properly called the *Lymphatic Vessels of the Intestines* ⁽³⁰⁴⁾, and the common trunk, or *Thoracic Duct*, and the round bodies, or *lymphatic glands* as they are called, constitute the *Lymphatic System* ⁽³⁰⁵⁾.

As to the fabric of the lymphatics, they are composed of membranes, thin and transparent, yet strong enough, considering their nature; these membranes are endued with muscular fibres, proper vessels and nerves, as is clearly demonstrated from their irritability in evacuating their liquid contents, and from their becoming inflamed and painful ⁽³⁰⁶⁾.
Like

⁽³⁰⁴⁾ Why more properly called *Lymphatic Vessels* of the Intestines? The body is not nourished by lymph, but by chyle; and it is the office of these vessels coming from the intestines to carry chyle into the blood. There is no other route for the chyle into the blood, than by these vessels. Nevertheless, though it be certain that the thoracic duct is a common trunk both to the lymphatics, and to the lacteals, yet the discoverers imagined the lymphatics to be a distinct order of vessels from the lacteals, which they called *Venae Lacteae*. Moreover, the lacteals transmit lymph, when the chyle is all carried to the subclavian veins; and the lymphatics, which ordinarily carry only lymph, have, in consequence of an anastomosis of the lymphatics of the liver and diaphragm with the lacteals of the mesentery, been found full of chyle (Haller n. 1. and 4. on § 121. of *Boerh. Prael. in Prop. Inst.* also Cruikshank, p. 89.).

⁽³⁰⁵⁾ It is now-a-day called the *Absorbing System*, for the red veins do not absorb.

⁽³⁰⁶⁾ Though fibres can scarcely be seen in the thoracic duct of man, yet Mr. Cruikshank saw them very remarkable in an uncommonly large one. He has de-

Like other veins, they have many valves disposed in pairs; in some places, three or four pair of valves occur in the space of an inch, to hinder the return of the contained liquid⁽³⁰⁷⁾.

They arise by very small ramifications from

demonstrated that the lymphatic vessels consist of coats, and that each coat consists of fibres. His method was this; he inverted a portion of the thoracic duct of a horse, and drew it on a glass cylinder (p. 61.).

As the Arteries and Veins are vascular, so likewise the absorbents have their *Vasa Vasorum*. The inflammation of them is a proof of their having arteries and veins, had not the former been frequently filled with coloured matter. They must also have absorbing vessels.

Are the absorbents sensible? They are certainly irritable; but this may depend on their muscular part.

⁽³⁰⁷⁾ The figure of these valves is that of a parabole; attached by its circular edge to the inside of the absorbent vessel, its detached edge, which marks the diameter, fluctuating loosely in the cavity. Hence fluids can only go one way in these vessels, for if they be driven backwards, the valve is raised from the side, and its loose edge is thrown into the diameter of the cavity of the vessel. Now there being commonly a pair of valves, both being raised by the retrograde motion of the contained fluid, and both being opposite each other, it follows that, in such instance, the route of the fluid must be entirely stopped. Mr. Cruikshank says they are frequently found intersecting the vessels, at equal distances, about the eighth or sixteenth of an inch apart (p. 66.). There are generally seven or eight pair of valves in the length of an inch. There is commonly a pair wherever an absorbent enters a vein, or when it enters the thoracic duct. But sometimes there is only one. Mr. Cruikshank saw a lymphatic vessel pass the length of six inches, without a single valve.

the

the whole surface of the body ⁽³⁰⁸⁾, from the subcutaneous cellular membrane ⁽³⁰⁹⁾, and from the larger cavities ⁽³¹⁰⁾; from the breasts ⁽³¹¹⁾, and lastly, from the various *viscera*. These ramifications coming gradually together, form themselves into branches, and these branches, after the same manner, terminate in one common trunk.

They are terminated in the thoracic duct, into which they evacuate their contents: Nevertheless, some of them are inserted here and there in the greater red veins ⁽³¹²⁾. Before they are terminated in the common trunk, they enter the lymphatic glands, as they are called, in their course, and go off from their op-

⁽³⁰⁸⁾ Hence mercury is absorbed from the skin, and carried into the blood, to affect the salivary glands; hence also the venereal and other poisons contaminate the whole habit.

⁽³⁰⁹⁾ In animals dying of hemoptoë, when blood is effused into the cells of the lungs, it may often be seen in the lymphatics. Besides, injections, that are extravasated, frequently get into the lymphatics.

⁽³¹⁰⁾ Thus is Dropsy often cured.

⁽³¹¹⁾ Whenever the lactiferous tubes are filled with mercury, the lymphatics are likewise filled.

⁽³¹²⁾ Mr. Cruikshank says he never saw a lymphatic vessel inserted into any other red veins, than the subclavians and jugulars (p. 99.): though Professor Meckel, the Father, had asserted, that the lymphatics of the stomach communicate with the veins of that part (*Diff. Epist. ad Hallerum.*); and Meckel, the Son, had affirmed the same of the absorbents of the ear (*Diff. De Labyrinthi auris contentis, &c.*).

posite side to arrive at the thoracic duct⁽³¹³⁾.

They are present, perhaps in every part of the body, and also on the surface of almost all the *viscera*, e. g. in the most remote parts of the superior and inferior extremities, in the face, in the muscles of the tongue, in the neck, in the lungs, in the liver, in the spleen, in the mesenteric glands, in the breasts, in the testicles, in the spermatic cord, about the *aorta* and iliac veins; and, in short, wherever there are lymphatic glands.

Of their *Use* it may be said, they absorb the fluids deposited on the surface of the body, the coagulable lymph from the greater cavities, and the chyle from the cavity of the intestines. All these they carry to the thoracic duct, that they may there be mixed and diluted one with another⁽³¹⁴⁾.

⁽³¹³⁾ As they enter a gland, they acquire the name of *Vasa Inferentia*: as they go out, they are called *Vasa Efferentia*. The *Vasa inferentia* are almost always more numerous than the *efferentia*; but they are not so large. The *vasa efferentia* are largest near the thoracic duct.—As we are certain that the thoracic duct cannot be filled from either of the lower extremities, without the injected matter passing, at the same time, through a greater or less number of glands, may we not reasonably infer, that no lymphatic enters that duct, that has not previously gone through a gland? Mr. Cruikshank makes one exception to this, which is, that the thoracic duct may be injected from lymphatic vessels on the back, without any gland being injected (p. 79.).

⁽³¹⁴⁾ Haller could hardly believe that the chyle can be thus diluted, because lymph is itself gelatinous (*Nota 2. in § 126. Boer. Prael. Acad.*).

The fluid of the lymphatic vessels, of the cellular membrane, and of the cavities of the body, seems to differ from the lymph of the blood, in this only, that it contains water ⁽³¹⁵⁾.

Of the Lymphatic Vessels.

There are two classes of lymphatic vessels, belonging to the lower extremities; of which the one is superficially, but the other deeply seated ⁽³¹⁶⁾. We shall consider both classes.

I.

The *superficially seated lymphatics* lie between the skin and muscles, and are to be referred to the common integuments of the body. One branch runs from the toes upon the back of the foot, and ascends the tendon of the *cruraeus anticus* muscle; is often di-

⁽³¹⁵⁾ Certainly the lymph of the blood contains water also. Mr. Hewson could conceive no difference between the fluid of the lymphatic vessels and that of cavities; but Mr. Cruickshank could never coagulate the latter in a less heat than would rise the mercury to 140 or 160 of Fahrenheit's scale (p. 105.).

⁽³¹⁶⁾ The superficially seated lymphatic vessels of the extremities are by far more numerous than the subcutaneous veins; the former being often in the proportion of fourteen to one.—The deeply seated lymphatics of the extremities are, at least, twice as many as the arteries, which they attend: they arise by the sides of the toes, and like the veins accompany the arteries, two on each side of an artery.

vided

vided above the ancles, and forms a kind of *plexus*, proceeding along the *tibia* under the skin, and in the cellular membrane between that bone and the *gastrocnemius* muscle, as high as the inside of the knee; from hence again, immediately under the skin and above the muscles of the thigh to the *groin*, where these various branches pass through the lymphatic glands (³¹⁷).

Of these glands, of which there are six or eight, some are situated in the angle which the thigh makes with the abdomen, but others lie a little deeper, in the anterior part of the thigh. The lymphatic vessels already mentioned enter the last of these glands, one only excepted, running to the superior glands, through which these lymphatics pass, that comes from the *pubis*. It is from this cause, that venereal buboes are almost always in the superior glands; and, on the contrary, that the inferior lymphatic glands are principally affected by *pus* absorbed from diseased bones. The lymphatics of the genitals, with those already mentioned, form a net-work, which entering the cavity of the abdomen under Poupart's ligament, gives off branches which in part surround the iliac artery, but are chiefly bestowed on its internal side (³¹⁸).

All

(³¹⁷) Not always; for sometimes two or three pass by the glands of the groin, entering no gland till they have passed under Poupart's ligament.

(³¹⁸) The number of the inguinal glands is uncertain.

The

All these superficial vessels, as one may rationally conjecture, are trunks of branches destined for absorption, in every part of the lower extremities, in the cellular membrane, and under the skin.

From the foot to the groin, there is in general no lymphatic gland for these vessels to pass through; but this is not always the case.

II.

The *Second Class* of lymphatic vessels belonging to the lower extremities, as was observed above, is more deeply seated, between the muscles, and accompanies the femoral artery. The first of these trunks is situated next the internal angle, and runs with the posterior tibial artery. From hence it ascends the bone posteriorly under the muscles, meets a small lymphatic gland in the middle of the leg (³¹⁹), and always adheres next the artery; coming from this gland again it ascends into the ham, and sinks into two lymphatic glands.

The branches ascend from thence with the femoral artery, over the *biceps* muscle, into

The greater number are above the *fascia* of the thigh; but a few are seated upon the *iliacus internus* muscle, between the *triceps* and *sartorius*. Mr. Cruikshank never saw any glands between the popliteal and inguinal (p. 133-134.)

(³¹⁹) As Leber copied Hewson on the Lymphatic vessels, so, it is probable, he first and only heard of this gland from him.

some

some inguinal gland situated more deeply than any of the rest; but, at last, into the *inferior* ones, as we have called them, where uniting with the lymphatics of the first class, and others coming from the *pubis*, the whole of them enter the cavity of the abdomen, through the abdominal ring.

The Lymphatic Vessels of the abdominal and thoracic Viscera.

Some branches accompany the external iliac artery from the abdominal ring to the brim of the *pelvis*; others pass through this cavity as far as the ischiatic notch, running in the course of the internal iliac artery; in which course, they meet others coming from the urinary bladder, from the uterus, or spermatic vessels, and a few arisen from the *glutaei* muscles. In the gravid uterus, lymphatic vessels are easily detected. Again:—Others are carried with the external iliac artery over the *psoas* muscle under the aorta to the loins; then to the *os sacrum*, where, together with the vessels of the other side, they constitute regular and elegant net work, over against the *psoas* muscle. There are very many lymphatic glands between Poupart's ligament, and the lumbar region.

Being collected one after another, together with the lacteal vessels, they form the thoracic duct under the *aorta*, at the second vertebra of the loins.

The

The abdominal viscera also send their chief branches to the thoracic duct.—From the *Kidneys* a great *plexus* comes, which runs backward from the renal vessels, and unite with some trunks at the aorta. The vessels likewise which arise from the renal glands proceed to this place.

The lymphatic trunks of the spleen are seated in its concave side, accompany the artery from thence to the pancreas, and are united in its concavity with those of that *viscus*.

The *Stomach* has two kinds of these vessels. Some run on its less curvature, with the coronary vein, and pass through glands situated there; others creep along the larger curvature with the right gastric artery, and pass through similar glands. Both these kinds of vessels meet at the inferior orifice of the stomach, and make a net-work at the less flexure of the duodenum, with which the lymphatic vessels of the spleen, gall-bladder, and liver, are interwoven. This net-work, above and below the intestine, passes to the thoracic duct.

The larger *viscera* of the abdomen have for the most part, a double class of lymphatic vessels: the one situated superficially, the other deeply, and accompanying the larger arteries. In the *Liver*, both classes communicate. Some of them, which are placed on its convex surface, descend with the descending *cava*: others are sent in the direction of the right ligament, to the diaphragm and thoracic duct. The vessels

fels of the concave surface are joined with those coming from without at the *vena portae*.

The lymphatics of the stomach are all inserted in the thoracic duct.

The Lacteals, Receptaculum Chyli, and Thoracic Duct.

The *Lacteals* are tender, transparent lymphatics, possessed of many valves which arise from the small and large intestines, absorb the chyle prepared in the intestines, and carry it to the *receptaculum chyli*. They arise from the internal surface of the villous coat, perforate the other coats, and form a kind of net-work; whilst the greater number unite one with another, in the third cellular coat, between the muscular and the external; from hence they proceed, between the *laminae* of the mesentery to the conglobate glands situated there; through which they pass, and constitute the greatest part of a gland, being distributed through it many times. The Lacteals having passed from these glands, go to others, and at length seek those in the centre of the mesentery, contiguous to one another. From these glands only four, five, or perhaps more lacteals, pass out, ascend with the mesenteric artery, and unite with the lymphatic vessels of the lower extremities, and of the abdominal

viscera, constituting at length a vessel which is called *Receptaculum Chyli* ⁽³²⁰⁾.

The *Use then of the Lacteal Vessels* is to absorb the chyle and carry it to the *Receptaculum chyli*.

The *Receptaculum Chyli* is a large membranous sack, situated between the *aorta* and the right *crus* of the diaphragm; but extended above the diaphragm into the cavity of the chest.

Its *Figure* from above and below is conical, hence it is wider in the middle, but in such a proportion, that its diameter never exceeds three lines, though its length exceeds two inches. So it happens, for the most part; yet in the place of one *receptaculum chyli*, there are sometimes two or three less ducts.

The use of it is to receive, to mix, to dilute, and to attenuate the coagulable lymph brought

(320) In turtle, and in fish, as well as in certain quadrupeds, the dog especially, this enlargement is of a greater size, in proportion to the duct, than in man, in whom it is so small as scarcely to deserve the appellation of *Receptaculum Chyli* (See Hewson's Exp. Inq. Part II. and Cruikshank.).

The thoracic duct, formed of the trunks of the absorbents of the right and left leg, and the trunk of the lacteals begins commonly on the left side of the spine, on the third *vertebra* of the loins. The three trunks sometimes lie parallel one to another, without being joined, for the space of an inch or two. At the first lumbar *vertebra*, when the thoracic duct gets above the diaphragm, it lies on the right side of the anterior surface of the spine, between the *vena azygos* of the right side, and the *aorta* of the left. Perhaps the pulse of the *aorta* contributes to propel the absorbed fluids of the thoracic duct into the blood (See Cruikshank.).

from

from the lower extremities, and abdominal viscera; also chyle already diluted in some degree, in the mesenteric glands.

The *Receptaculum Chyli* is terminated in the *Thoracic Duët*, so called from the course which it takes.

This *Thoracic Duët* is situated behind the *pleura*, between the *Aorta* and *Vena Azygos*. Being variously reflected, it ascends, and receives in its course the lymphatics of the stomach, the *oesophagus*, and the lungs.

The *Figure of the Thoracic Duët* is that of a cylinder; yet it is often divided, especially at its superior part, and again conjoined into one tube. It passes towards the left, behind the *oesophagus* to the fifth *vertebra* of the back: it ascends through the left side of the thorax behind the subclavian vessels, to about the sixth *vertebra* of the neck; from hence it descends, sometimes single, sometimes bifurcated, and is inserted at the union of the subclavian with the internal jugular vein ⁽³²¹⁾.

It

⁽³²¹⁾ The Thoracic duët is inserted into the left subclavian vein, chiefly because its contents should not be stopped by the retrograde motion of the blood in the *cava superior*, and its branches, during the contraction of the right auricle.

Though it did not appear from Haller's Experiments, that the Thoracic Duët or Lymphatics become painful upon the application of stimulants; yet the thoracic duët, throughout its whole length, is surrounded by the ramifications of the *par vagum* and intercostal. And what is still to be noticed is, that in some experiments of Mr. John Hunter (Dr. Hunter's Med. Comment. Chap. V.),

It possesses few valves, and those placed without order; but before its aperture there is a valve almost circular, impeding the ingress of blood into its cavity ⁽³²²⁾.

The thoracic duct is ordinarily found of the form above described, yet there are instances where it is double, but afterwards joined again into one trunk. It is likewise sometimes divided into two branches at its end, and inserted by means of these into both subclavian veins; or one branch is inserted into the *vena azygos*, or left jugular vein.

But when it is terminated by many branches, a valve is placed at the end of each.

Of its use it may be said, that it mixes the chyle brought from the lacteals to the *receptaculum chyli*, and propels it onwards to the veins already mentioned.

In the *lungs*, some vessels pass from each lobe to the thoracic duct, others anteriorly to the jugular, or to the subclavian vein.

It is particularly to be noticed at present, that all the lymphatic vessels of the abdominal *viscera* do not pass through glands, and the same is to be observed of the lacteals; hence a wasting of the body should not always be

when the arteries and veins and nerves of the intestine were tied up, and consequently the connection of the brain and lacteals destroyed, the fluids were nevertheless absorbed by the lacteals from the cavity of the intestines.

⁽³²²⁾ There is great variety in the distribution of the valves of the absorbents, in different bodies: sometimes the thoracic duct has only three or four pair of valves; sometimes it is crowded with them (Cruikshank, p. 66.).

attributed

attributed to an obstruction of the mesenteric glands.

It might not have been unnecessary to have inserted in this place a more exact description of the lymphatic glands.

Beside the glands of the *Mesentery* and those of the *Mesocolon* and *Stomach*, there are many others proper to the *Pancreas*, situated on each side especially near the duodenum. In the *Omentum* also there are generally two. On the inside of Poupart's ligament, there is a large lymphatic gland: and there are various glands on the psoas muscle, and in the pelvis at the internal iliac artery, and again there are many glands situated at the vertebrae of the loins. The *Kidneys*, the *Supra-renal glands*, the *Spleen*, and the *Liver*, have each their proper lymphatic glands. There are some glands in the middle of the thorax at the thoracic duct, near the egress of the lymphatic: numerous glands are also present at the root of the lungs; but in the lungs there is no gland. Lastly, there are some glands between the surface of the lungs and the subclavian veins; others in the angle which this vein forms with the jugular, at the angle near the pharynx, and sometimes inferiorly between the ribs. The black glands at the branches of the *aspera arteria*, are altogether of the same nature as the lymphatic glands, as will be noticed in the *Adenologia*, and secrete no mucus. Similar glands are not constantly found at the column of the spine of
the

the back. Moreover, lymphatic glands are found near the maxillary and parotid glands; near the mental and occipital arteries; and at the mastoid process. These glands sometimes swell from absorbed pus, wounds of the head, or abscesses, from rotten teeth, or ulcers of the lips.

The Lymphatics of the Neck and Head.

A Lymphatic Vessel runs along with the internal jugular vein, which constitutes the trunk of those occupying the middle part of the head and neck: some branches accompany the external carotid. Lymphatic vessels are not discernible in the brain; neither is the pineal, nor the pituitary gland, of the lymphatic kind; but it is probable that even the brain has lymphatic vessels.

The ramifications about the external carotid unite in the neck into one trunk, accompanying the jugular vein, and passing through lymphatic glands near the termination of this vein in the subclavian. There are too some lymphatic glands at the angle of the jugular and subclavian vein, through which the lymphatic vessels, coming from the posterior part of the neck, and scapula, pass.

The *Thyroid Gland* has many lymphatics, which may be rendered more conspicuous by inflating them with air. One part goes to the angle already noticed, another to the thoracic duct.

The

The Lymphatics of the Upper Extremities.

As of the inferior, so of the superior extremities, there are two classes of lymphatic vessels; the one seated superficially, the other deeply.

I.

The superficially seated lymphatics are best seen in the emaciated and dropsical; they ascend under the skin upon the posterior surface of the fore-arm, and proceed onward to the head of the *radius*: one branch ascends in the internal surface, is extended under the internal condyle of the *humerus*, and sends forward a small branch, over the tendon between the muscles and the bones, where it is joined with another more deeply seated, while the other branches ascend from the head of the *radius* over the *supinator longus*, and *biceps* muscle, and pass through the lymphatic glands of the axilla. But the particular branch, from which the smaller one already noticed was sent, ascending over the articulation, reaches a gland; from which it passes on the inside of the fore-arm to the axillary glands. Another lymphatic vessel goes along the fore-arm anteriorly from the metacarpus, and forms a net-work with another coming over the cubit from the posterior side, which is continued inwardly on the humerus to the glands of the *axilla*.

II.

Of the deeply-seated lymphatics accompanying the larger blood-vessels, we shall at present especially describe that which follows the radial vein. It runs between the cubital and interosseal artery, and internally accompanies the brachial artery: in the middle of the *humerus* it goes through two glands, and then being divided, it rather emerges, passes under one of the anastomosing arteries, and ascends to the lymphatic axillary glands. But such branches, as it appears, accompany all the larger arteries. For that absorbent vessels should be present in every part of the arm is evident, in inoculation for the small-pox, which, considering the part wherein the virus is inserted, always succeeds.

Two principal branches of the lymphatic vessels belonging to the superior extremities, unite into one trunk under the subclavian vein, which is commonly inserted in the angle of the vein, at the entrance of the thoracic duct. In that place, it is joined with branches from the head, neck, thyroid gland, and anterior part of the lungs.

All that has hitherto been said respects the left side. The absorbents of the right side, for the most part, follow the same course. A trunk, joined to the thoracic duct, has four principal branches, one coming from the arm, and the other three from the thyroid gland, head,

head, and lungs (³²³). The difference of this course of the lymphatic vessels on the right side being plainly perceived, will serve for the explanation of topical tumours.

(³²³) The principal trunk of the absorbents being now described, which enters the angle formed by the left jugular and subclavian vein; we come next to speak of that which is inserted in the same angle, on the right side. The length of this is generally a quarter or half an inch only. Its diameter is like that of the thoracic duct of the left side, at the same place. It is formed of the absorbents of the right lobe of the liver, the right side of the diaphragm, the right side of the heart, the right lobe of the lungs, the right arm, the right side of the head, and the right lobe of the thyroide gland.

The reason that the trunks of the absorbing vessels terminate in veins, and not in arteries, is because in the former there is less resistance to the influx of the chyle than in the arteries, where the motion of the blood is quicker. They terminate in the angles between the jugulars and subclavians, because the resistance of the blood to any fluid entering the veins, must be less, as that blood comes nearer the heart.—They enter at the angle; because the absorbed fluids may go in the same diagonal as the blood of the jugulars and subclavians (See Cruikshank.).

END OF THE FIRST VOLUME.